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FACT BOOK
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CHAPTER I

THE PHARMACEUTICAL INDUSTRY IN THE U.S.

BACKGROUND ON THE INDUSTRY

Although U.S. pharmaceutical manufacturing dates back to the mid-nineteenth century, it began to emerge as a major industry about 50 years ago. Prior to the 1930s there were many small firms, but only a few conducted research. Most pharmaceutical preparations were compounded by pharmacists in their shops and dispensed directly to consumers.

Introduction of the first sulfa drug in 1935 stimulated interest in pharmaceutical research and set the stage for the successful development of penicillin, the most significant of many pharmaceuticals developed during World War II. Sulfa drugs and antibiotics saved the lives of countless Americans and allies during that period. The 15 years between 1938 and 1953 have come to be known as "The Age of Antibiotics" because a number of useful new anti-infectives were discovered. Leadership in the industry, in total sales as well as in new drug discoveries, shifted from Europe to the U.S. during World War II. American firms substantially increased their research and development efforts.

This strong commitment to drug research and development is demonstrated by continued U.S. leadership in the introduction of new chemical entities during the past 50 years. A detailed discussion of these new product introductions is presented in Chapter II.

Numerous laws govern the production, distribution, and marketing of prescription drugs on both the state and federal levels. Federal regulation began with the 1906 Pure Food and Drugs Act. This Act was designed to protect consumers by requiring, in part, that the ingredients of a medicine be truthfully stated on the package label. This law was strengthened considerably in 1938 with the passage of the Food, Drug and Cosmetic Act, under which drug manufacturers were required to demonstrate that a drug was safe for the use stipulated on the label. Federal control over prescription drugs was broadened further by the 1962 Amendments to the Food, Drug and Cosmetic Act which required manufacturers to show that a new drug is effective for its intended uses.

INDUSTRY OVERVIEW

Marketing research data for 1989 indicate that approximately 790 corporations and companies in the U.S. are engaged in the manufacture and sale of ethical and proprietary pharmaceuticals.[1] The U.S. Department of Commerce estimated that the value of shipments of pharmaceutical products by all manufacturers in the U.S. was $45.5 billion in 1990. PMA member firms traditionally account for about 90 percent of the industry's U.S. sales of human dosage form drugs.

Many prescription drug firms produce other health-related products. In addition to prescription and over-the-counter drugs, many large firms also make veterinary products and agricultural chemicals. A large number of companies also manufacture medical equipment, medical devices, diagnostic products, and hospital supplies. Some firms are important suppliers of chemicals used in other industries.

Drug manufacturing facilities are concentrated largely in New Jersey, New York, Pennsylvania, Indiana, Illinois, Michigan, Missouri, Ohio, California, and Puerto Rico. Through networks of distribution centers and wholesale distributors, pharmaceutical products are available to patients in more than 6,700 hospitals and 66,000 pharmacies.

SALES AND SALES GROWTH

For the period 1967-1989, total worldwide annual sales of PMA member firms grew by over 900 percent, from $4.9 billion to $50.1 billion (Table 1-1). Until recently, the major source of this growth was increased foreign sales. Annual domestic sales increased over 800 percent, but foreign sales increased by more than 1000 percent. In 1980, foreign sales represented 47 percent of total worldwide sales, compared to 30 percent in 1965. However, this percentage declined to 34 percent by 1989.

SALES BY PRODUCT CLASS

As sales have grown over the years, the percentage of total sales has changed for various classes of products. In 1989, sales in the U.S. of drugs acting on the cardiovascular system led all other categories. In addition, the relative share for cardiovascular drugs more than doubled from 1972 to 1989 (Table 1-2).

Foreign sales of U.S. companies by product class show different rankings than domestic sales with anti-infectives leading in sales in 1989 (Table 1-3).

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[1] Based on data from IMS, America Ltd.

TABLE 1-1

U.S. AND FOREIGN PHARMACEUTICAL SALES
PMA MEMBER FIRMS
1967-1989
($ millions)

Year	Domestic Sales			Foreign Sales (including Exports)			Total Domestic and Foreign
	Human	Veterinary	Total	Human	Veterinary	Total	
1989	$32,208.3	$1,113.3	$33,321.6	$15,749.7	$1,068.2	$16,817.9	$50,139.5
1988	28,196.6	1,128.0	29,324.6	16,364.1	1,285.2	17,649.3	46,973.9
1987	25,528.9	1,037.2	26,566.1	14,225.7	842.7	15,068.4	41,634.5
1986	23,173.6	933.2	24,106.8	12,218.2	812.3	13,030.5	37,137.3
1985	20,265.0	888.5	21,153.5	10,129.6	742.7	10,872.3	32,025.8
1984	18,520.5	882.6	19,403.1	9,696.7	754.2	10,450.9	29,854.0
1983	16,218.2	876.8	17,095.0	9,645.4	765.8	10,411.2	27,506.2
1982	14,156.5	830.4	14,986.9	9,902.1	765.3	10,667.4	25,654.3
1981	12,100.4	761.6	12,872.0	9,895.2	763.1	10,658.3	23,530.3
1980	11,299.8	697.8	11,997.6	9,758.2	757.2	10,515.4	22,513.0
1979	9,558.8	644.2	10,203.0	7,916.2	648.6	8,564.8	18,767.8
1978	8,678.6	506.8	9,185.4	6,566.5	524.5	7,091.0	16,276.4
1977	7,907.1	428.6	8,335.7	5,403.8	406.7	5,810.5	14,146.2
1976	7,314.7	411.5	7,726.2	4,908.2	385.5	5,293.7	13,019.9
1975	6,602.8	301.0	6,903.8	4,467.6	328.7	4,796.3	11,700.1
1974	5,846.5	280.2	6,126.7	3,683.6	256.6	3,940.2	10,066.9
1973	5,258.6	269.1	5,527.7	3,078.5	199.5	3,278.0	8,805.7
1972	4,815.2	238.8	5,054.0	2,602.9	203.4	2,806.3	7,860.3
1971	4,510.4	199.0	4,709.4	2,212.7	175.2	2,387.9	7,097.3
1970	4,185.3	256.5	4,441.8	1,981.2	170.6	2,151.8	6,593.6
1969	3,894.8	216.4	4,111.2	1,702.3	154.5	1,856.8	5,968.0
1968	3,588.8	204.9	3,793.7	1,493.9	156.8	1,650.7	5,444.4
1967	3,199.1	211.8	3,410.9	1,350.8	147.2	1,498.0	4,908.9

Source: PMA Annual Survey.

TABLE 1-2
MANUFACTURERS' DOMESTIC SALES OF ETHICAL DRUGS FOR HUMAN USE
BY PRODUCT CLASS
1972*, 1986, 1987, 1988 and 1989

	Relative Share of Sales				
	1972	1986	1987	1988	1989
Central Nervous System	26.0%	24.7%	21.4%	21.7%	21.4%
Anti-Infectives	12.8	16.9	17.1	15.3	15.6
Gastrointestinal & Genitourinary	10.7	11.2	12.5	11.7	13.5
Neoplasms and Endocrine	12.0	13.0	13.1	13.1	13.3
Vitamins and Nutrients	7.6	3.8	3.6	3.3	2.9
Cardiovasculars	8.4	19.6	21.7	22.5	22.5
Respiratory System	6.6	6.3	6.4	7.4	7.5
Dermatologicals	3.3	2.3	2.2	2.6	2.3
Other	12.6	2.2	2.0	2.4	1.0
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%

* 1972 was the first year that data were reported consistently by product class.
Source: PMA Annual Survey.

TABLE 1-3

FOREIGN SALES OF ETHICAL DRUGS FOR HUMAN USE
BY PRODUCT CLASS AND DOSAGE FORM
1987, 1988 and 1989

	Relative Share of Sales		
	1987	1988	1989
Anti-Infectives	21.6%	24.8	22.4
Central Nervous System	16.3	15.4	15.3
Neoplasms and Endocrine	13.2	12.9	13.4
Gastrointestinal and Genitourinary	8.3	9.6	7.0
Respiratory System	7.5	4.2	4.4
Cardiovasculars	19.1	18.7	20.8
Vitamins and Nutrients	3.7	3.4	3.2
Dermatologicals	3.3	4.5	5.4
Biologicals	2.6	1.6	1.5
Diagnostic Agents	.4	.5	.7
Other Pharmaceutical Preparations	4.0	4.4	5.9
TOTAL	100.0%	100.0%	100.0%

Source: PMA Annual Survey.

DISTRIBUTION OF SALES BY CUSTOMER TYPE

Table 1-4 shows the distribution, by class of customer, of human use, dosage form ethical pharmaceutical sales in the U.S. These sales are direct sales by the manufacturer. Retail pharmacies and hospitals, the usual sources of prescription drugs for patients, buy pharmaceuticals from wholesalers as well as directly from the manufacturer. However, manufacturers have shifted sales in recent years toward wholesalers and away from retailers.

TABLE 1-4

PERCENTAGE DISTRIBUTION OF U.S. ETHICAL PHARMACEUTICAL SALES BY CLASS OF CUSTOMER SELECTED YEARS 1977-1989

Class of Customer	1977	1979	1981	1983	1985	1987	1989
Wholesalers	49.1%	53.0%	59.2%	61.7%	67.3%	68.8%	71.3%
Retailers	25.5	22.5	18.0	17.2	16.0	15.9	15.5
Private Hospitals	15.1	14.9	13.9	12.6	8.8	7.4	5.9
State & Local Government Hospitals	4.5	4.0	3.9	3.5	2.5	2.1	1.9
Federal Hospitals	2.7	2.3	2.6	2.5	2.1	2.4	2.4
Other Federal Government	1.3	1.4	.9	1.2	1.6	1.3	1.1
Practitioners	1.1	1.2	.9	.7	.7	1.1	1.2
Manufacturers, Repackagers, and Other Direct Sales	.7	.7	.6	.6	1.0	1.0	.7
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: PMA Annual Survey (various years).

RETAIL SALES

Retail sales measure the value of drug products dispensed to the customer primarily through independent and chain retail pharmacies. The amount of money spent on prescription drugs is relatively small compared to the expenditures for other segments of health care. Sales of drugs and medical sundries in retail pharmacies accounted for only 7.4 percent of total national health expenditures in 1989. Retail pharmacy prescriptions alone accounted for about 4.08 percent of the national health dollar.

Table 1-5 shows retail prescription drug sales of $33.0 billion in 1990, an increase of 209 percent over 1980. The value of retail sales includes the cost of a product to the pharmacy as well as the retail mark-up or charge for professional dispensing services.

TABLE 1-5

U.S. RETAIL PRESCRIPTION DRUG SALES
SELECTED YEARS
1980-1990

($ millions)

Year	Value of Sales
1990	$33,028.0
1989	30,488.0
1988	26,734.0
1987	24,681.0
1986	21,821.0
1985	20,284.0
1984	18,366.0
1983	16,997.0
1982	15,536.0
1981	12,251.0
1980	10,680.0

Source: Pharmacy Times, April 1981-1991.

Retail sales figures are determined in part by the volume of prescriptions dispensed. Total prescriptions increased by 18.8 percent from 1980 to 1990 to 1.66 billion prescriptions (Table 1-6).[2]

[2] While significant changes have been made in the IMS, National Prescription Audit database, particularly in 1981 and 1983, it is unlikely that these changes had any effect on the trends shown in Table 1-6.

TABLE 1-6

U.S. PRESCRIPTION VOLUME
1980-1990

Year	New Rx's	Percent Change	Refills	Percent Change	Total Rx's	Percent Change
1980	750,289,000	2.4	644,019,000	1.7	1,394,308,000	2.1
1981	737,797,000	-1.7	681,772,000	5.9	1,419,569,000	1.8
1982	768,189,000	4.1	729,994,000	7.1	1,498,183,000	5.5
1983	742,399,000	-3.4	765,735,000	4.9	1,508,134,000	.7
1984	750,118,000	1.0	781,630,000	2.1	1,531,748,000	1.6
1985	755,468,000	0.7	792,944,000	1.4	1,548,412,000	1.1
1986	784,483,000	3.8	773,028,000	-2.5	1,557,511,000	0.6
1987	836,560,000	6.6	774,465,000	.2	1,611,025,000	3.4
1988	865,656,000	3.5	765,449,000	-1.2	1,631,105,000	1.2
1989	880,837,000	1.8	760,054,000	-0.7	1,640,891,000	.6
1990	894,341,000	1.5	762,037,000	.3	1,656,378,000	.9

Source: IMS, National Prescription Audit, Various Years.

INTERNATIONAL OPERATIONS

The U.S. pharmaceutical industry is the largest of any nation. Although organized primarily to satisfy the large domestic market, American producers are exceptionally active in foreign trade and investment, and contribute substantially to the U.S. balance of payments.

The most comprehensive measure of the industry's contribution to the balance of payments emerges from data compiled by the International Trade Administration, U.S. Department of Commerce. These data include finished dosage form preparations, biologicals and medicinal chemicals which include drugs in bulk such as sulfonamide and acetylsalicylic acid, enzymes, certain inorganic medicinal chemicals and prepared culture media.

The balance of trade in pharmaceuticals remains positive at $1,384 million in 1990 (Table 1-7). This was an increase over the 1989 balance of $899.7 million.

According to United Nation's statistics for 1988 (Table 1-8), Germany is the largest exporter of pharmaceutical products. The U.S. is the second largest importer. U.S. pharmaceutical products are sold in nearly every country of the free world. Japan is by far the leading recipient of U.S. pharmaceutical exports, receiving over 20 percent of the total. Almost one-half of U.S. exports are sent to Europe, and over 20 percent go to developing countries (Table 1-9).

TABLE 1-7

FOREIGN TRADE OF THE UNITED STATES IN
MEDICINALS AND PHARMACEUTICAL PREPARATIONS
1989-1990
($ Millions, f.a.s. values)

Year	Total Exports	Total Imports	Net Exports
1989	$4,423.3	$3,523.6	$899.7
1990	5,185.2	3,801.6	1,383.6

(Percentages in the table above indicate changes from the preceding year.)

Source: International Trade Administration, U.S. Department of Commerce.

TABLE 1-8

WORLD TRADE IN MEDICINAL AND PHARMACEUTICAL PRODUCTS
1988
($ Thousands)

Countries	Exports	Imports	Balance of Trade
Leading Net Exporters			
Switzerland	$3,207,339	$1,067,057	$2,140,282
Germany (F.R.)	5,073,654	2,955,562	2,118,092
United Kingdom	3,662,476	1,773,432	1,889,044
France	2,734,138	1,701,462	1,032,676
United States	4,199,472	3,234,590	964,882
Denmark	952,954	414,725	538,229
Sweden	771,711	648,197	123,514
Netherlands	1,224,058	1,126,185	97,873
Belgium	1,158,323	1,087,928	70,395
Leading Net Importers			
Mexico	$ 45,008	$ 118,464	$- 73,456
Argentina	23,770	108,409	- 84,639
Indonesia	18,285	129,371	- 111,086
Hong Kong	406,865	531,516	- 124,651
Portugal	56,957	200,076	- 143,119
Brazil	94,123	241,903	- 147,780
Korea Republic	103,499	253,293	- 149,794
Norway	83,701	262,288	- 178,587
Greece	22,947	210,963	- 188,016
Thailand	18,413	224,227	- 205,814
African Customs Union	14,314	299,331	- 285,017
Austria	422,771	712,132	- 289,361
Australia	155,857	534,401	- 378,544
Egypt	35,420	448,147	- 412,727
Canada	161,211	663,689	- 502,478
Italy	1,321,481	2,330,112	-1,008,631
Japan	929,845	3,648,260	-2,718,415

Source: 1988 International Trade Statistics Yearbook, U.N., Vol. II.

TABLE 1-9

FOREIGN TRADE OF THE UNITED STATES IN
MEDICINALS AND PHARMACEUTICAL PREPARATIONS BY WORLD AREAS
1989-1990
(Thousands of dollars, f.a.s. values)

Area	1989	1990
Canada		
Exports	$352,280	$551,273
Imports	65,519	88,809
Net U.S. Exports	286,761	462,464
Latin American Republics:		
Exports	306,022	365,321
Imports	42,221	57,292
Net U.S. Exports	263,801	308,029
Other Western Hemisphere:		
Exports	33,904	29,101
Imports	284,839	303,574
Net U.S. Exports	-250,935	-274,473
United Kingdom:		
Exports	228,134	251,277
Imports	674,634	660,302
Net U.S. Exports	-446,500	-409,025
E.E.C. Countries (incl. U.K.):		
Exports	1,884,851	2,288,666
Imports	1,930,232	2,112,732
Net U.S. Exports	-45,381	175,934
OECD Countries of Europe:		
Exports	2,242,027	2,709,629
Imports	2,504,808	2,813,062
Net U.S. Exports	-262,781	-103,433
Japan:		
Exports	910,897	882,667
Imports	423,253	352,453
Net U.S. Exports	487,644	530,214

TABLE 1-9
(Continued)

FOREIGN TRADE OF THE UNITED STATES IN
MEDICINALS AND PHARMACEUTICAL PREPARATIONS BY WORLD AREAS
1989-1990

(Thousands of dollars, f.a.s. values)

Area		1989	1990
Other Asia:*			
	Exports	$ 371,404	$ 413,176
	Imports	98,785	85,419
	Net U.S. Exports	272,619	327,757
Australia & Oceania:			
	Exports	102,306	113,927
	Imports	13,142	11,794
	Net U.S. Exports	89,164	102,133
Africa:			
	Exports	62,017	66,393
	Imports	2,920	1,817
	Net U.S. Exports	59,097	64,576
Principal Developing Areas:**			
	Exports	773,347	873,991
	Imports	428,765	448,102
	Net U.S. Exports	344,582	425,889
World Total:***			
	Exports	4,423,279	5,185,225
	Imports	3,523,558	3,801,582
	Net U.S. Exports	899,721	1,383,643

*Excludes Japan and Communist Asia.
**Based on combined figures for Latin America, other Western Hemisphere, Asia other than Japan and Communist areas, and Africa.
***Totals include Communist areas not shown separately above.

Source: International Trade Administration, U.S. Department of Commerce.

In large part, U.S. exports of pharmaceutical products consist of ingredients and intermediate products sent abroad to be processed and packaged. This practice reflects practical considerations such as convenience in satisfying a market, the need to label medicines in a foreign language and the desire to meet the preferences of local doctors and patients for certain dosage forms. The passage of the Omnibus Health Act in 1986 opened new exporting opportunities for pharmaceutical firms. Under the new law, firms can now export drugs that have not been approved by the U.S. Food and Drug Administration to a select list of countries that have approved the drugs. These drugs must be under clinical study here in the U.S. to be eligible for exporting.

In other cases, manufacturing abroad is encouraged by tariff or non-tariff barriers to imports, national laws, or other policies of a foreign country that make it difficult or impossible to market a product unless it is largely produced within its boundaries. In most instances, production in foreign countries has been a means of achieving sales that otherwise would not have been possible. Through foreign subsidiaries and affiliates, many U.S. companies increase their shipments of bulk materials and ingredients as well as supplies and equipment. This helps to sustain or expand U.S. domestic employment.

The production and sales of major companies through their networks of affiliates in other countries have contributed significantly to the industry's international importance. U.S. sales abroad, directly and through foreign branches and subsidiaries, exceeded $15 billion in 1990. These operations abroad have made important contributions to the economies of the countries in which the subsidiary operations are located. Foreign subsidiaries of U.S. firms establish local facilities that provide training and employment for local workers, add to tax revenues, contribute to the balance of payments of the host country, support local corollary industries, and reinvest earnings in the host country. In turn, various Swiss, West German, French and British firms have long owned and operated plants in the U.S.

Many PMA companies have subsidiaries or jointly-owned affiliates in other countries, and many other member companies engage in international operations through licensing and exporting. Sales achieved through manufacturing abroad greatly exceed direct exports from the U.S. (Table 1-10). Combined sales abroad in 1990 were nearly double the total ten years earlier.

Although most pharmaceutical sales abroad by U.S. companies are made to other advanced countries, U.S. companies also have significant pharmaceutical activities in developing countries. Many U.S. firms enjoy long-established relationships with Latin America and several countries in Asia and Africa. In fact, the U.S. pharmaceutical industry has invested heavily in

TABLE 1-10

FOREIGN SALES OF ETHICAL PHARMACEUTICALS
BY U.S.-OWNED PMA MEMBER FIRMS
1968-1990
($ Millions)

Year	Total Foreign Sales	Sales Abroad	Exports
1968	$ 1,650.7	$ 1,424.8	$ 225.9
1969	1,858.8	1,559.5	297.3
1970	2,151.8	1,807.7	344.1
1971	2,387.9	2,005.5	382.4
1972	2,806.3	2,428.4	377.9
1973	3,278.0	2,712.4	565.6
1974	3,940.2	3,206.2	734.0
1975	4,796.3	4,042.6	753.7
1976	5,293.7	4,398.9	894.8
1977	5,810.5	4,862.9	947.6
1978	7,091.0	6,026.3	1,219.3
1979	8,564.8	7,410.0	1,154.8
1980	10,515.4	9,296.1	1,219.3
1981	10,658.4	9,264.5	1,393.9
1982	10,667.4	9,221.1	1,446.3
1983	10,411.2	9,075.5	1,335.7
1984	10,450.9	9,110.1	1,340.8
1985	10,872.3	9,315.4	1,556.9
1986	13,030.5	10,986.3	2,044.2
1987	15,068.4	13,055.1	2,013.3
1988	17,649.3	14,953.1	2,696.2
1989	16,817.9	13,672.1	3,145.8
1990	19,375.3	15,751.1	3,624.2

"Exports" includes shipments to subsidiaries abroad as well as exports to nonaffiliated firms. These data are based on ethical pharmaceutical sales provided by member companies and are not directly comparable with Commerce Department or United Nations trade data.

"Sales Abroad" refers to sales in a foreign area by subsidiaries or other corporate operations, adjusted to eliminate double counting of intrafirm transactions. Also excluded are sales outside the U.S. by foreign-owned firms which have subsidiaries in the U.S.

Source: PMA Annual Survey, various years.

developing countries, employing thousands of local workers and helping build technological expertise. In addition to direct earnings from sales, patent royalties, fees received for management and engineering services, and other remittances from abroad help the industry improve the U.S. balance of payments.

CONCENTRATION

The Bureau of the Census compiles statistics on concentration ratios for over 400 American industries in the quinquennial Census of Manufacturers. These statistics include the share of total sales held by the four largest, eight largest and 20 largest firms in each industry.

Some industries, such as automobile or primary aluminum, are highly concentrated in that only a few companies account for a major share of industry sales. Other industries, such as concrete or commercial printing, have very low rates of concentration. The four-firm concentration ratio for the pharmaceutical industry ranks in the bottom 40 percent among the total of approximately 450 U.S. industries examined by the Bureau of Census (Table 1-11).

Using marketing research data, it is also possible to look at concentration ratios in terms of market share of new and refill prescription dollars. Table 1-12 includes data for 1982 through 1990. These data indicate that concentration in the industry has been declining more rapidly in recent years, although these data do not reflect the effects of some of the recent mergers.

TABLE 1-11

CONCENTRATION RATIOS FOR FIRMS MANUFACTURING PHARMACEUTICAL PREPARATIONS (SIC 2834)
Selected Years, 1958-1982

		Percent of value of shipments accounted for by:		
Year	Number of Establishments	4 Largest Companies	8 Largest Companies	20 Largest Companies
1958	1,114	25%	43%	71%
1963	1,011	22	37	71
1967	875	24	40	70
1972	756	25	43	73
1977	756	25	41	70
1982	683	26	41	67

Source: 1982 Census of Manufacturers, Pub.MC77-Sr-9, Subject Series, Bureau of Census, U.S. Department of Commerce, 1986.

TABLE 1-12

COMPETITION FOR NEW U.S. PRESCRIPTIONS
MEASURED IN TOTAL PRESCRIPTION DOLLARS

1982-1990

Company Group	Percentage of New and Refill Prescription Dollars [a,b,c]								
	1982	1983	1984	1985	1986	1987	1988	1989	1990
Leading Company	8.4%	8.3%	8.4%	7.5%	6.7%	7.2%	7.9%	8.2%	7.6%
4 Largest	29.5	29.6	29.2	27.1	25.0	23.6	23.0	24.7	24.5
8 Largest	48.9	48.4	47.7	44.7	43.4	41.3	40.4	43.6	41.6
20 Largest	79.4	78.4	77.0	74.1	74.9	73.7	72.4	72.4	74.7
50 Largest	96.7	96.1	96.2	94.3	97.5	96.1	94.9	95.6	95.1
All Companies	100.0%	100.0%	100.0%	100.%	100.%	100.0%	100.0%	100.0%	100.0%

a Pharmacy cost level.
b Data for 1982-1990 are for prescriptions as they were dispensed, not prescribed as was the case for earlier years.
c Sales of subsidiaries were combined with parent corporation sales in making calculations.

Source: National Prescription Audit, IMS America, Ltd.

One additional measure of industry concentration--the Herfindahl-Hirschman Index (HHI)--has been used to examine the effects of proposed mergers. This measure has been advocated as the appropriate market power measure for antitrust purposes.[3]

Table 1-13 shows the HHI values[4] for 1981 through 1990, using the same data upon which the concentration ratios of Table 1-12 were based. In examining the impact of merger activity, the critical value of the HHI that would trigger concern about a particular merger is not well-established. However, a value of 1000 is generally viewed as being unlikely to be challenged. As Table 1-13 shows, the pharmaceutical industry HHI is less than half of this usually accepted value, even after factoring in the intensive merger activity of the past year.

TABLE 1-13

PHARMACEUTICAL INDUSTRY CONCENTRATION
HERFINDAHL-HIRSCHMAN INDEX VALUE
1981-1990

Year	Index Value
1981	439
1982	414
1983	411
1984	394
1985	368
1986	342
1987	337
1988	329
1989	354
1990	365

Source: PMA calculation based on data from National Prescription Audit data, IMS, America.

EARNINGS

In a very real sense, earnings represent the end of the research-marketing-physician-pharmacist-consumer chain. Earnings also provide the capital necessary to finance a new cycle of research and so can be considered a beginning as well.

[3] Department of Justice Antitrust Division-Merger Guidelines, Federal Register, (June 1982), 28494-28502.

[4] The HHI is computed by squaring the market share for each firm, expressed in percent, and summing the result. This sum is then multiplied by 10,000 to express the HHI value in whole numbers.

By most measures, the pharmaceutical industry is profitable, with earnings traditionally above the average for all manufacturing industries. However, the concept of profitability is not sufficiently well-defined to rely on a single measure of profitability. No single measure conveys appropriate information to all economic agents interested in the performance of the industry. The results obtained using accounting data may differ from those obtained using capital market data.

Some commonly used accounting measures of profitability are: return on sales, return on stockholders' equity, return on capital employed, and return on assets. Return to investors[5] is an example of a capital market measure. To illustrate how relative profitability is sensitive to the measure of profitability chosen, consider the Fortune 500 Corporations for 1981-1990[6] and the following three measures of profitability:

(i) Return on Sales
(ii) Return on Stockholders' Equity
(iii) Return to Investors

Each firm in the Fortune 500 is classified into one of 26 industries including pharmaceuticals. The medians for the pharmaceutical industry and "all industries" for each of the three measures of profitability used in Fortune are given in Table 1-14.

The question of which measures of profitability are most appropriate for evaluating an industry remains a matter of personal judgment rather than logical derivation. However, policy discussions will often focus on measures that use readily available accounting data on sales, net income (earnings), and stockholders' equity. Earnings as a percent of sales both before and after taxes, are displayed in Table 1-16. Earnings as a percent of stockholders' equity are shown in Table 1-17.

Based on these measures of profitability, the pharmaceutical industry is a profitable industry. The industry also leads in terms of the percentage of its sales reinvested in R&D which involves considerable risks. The industry invested an estimated 16.5 percent of its sales in research and development in 1990.

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[5] Return to investors includes both stock price appreciation and dividend yield.

[6] There are 17-26 pharmaceutical firms included in each edition of Fortune 500.

TABLE 1-14

MEDIAN RETURN (%)
PHARMACEUTICAL/ALL INDUSTRIES

Year	Sales	Equity	Investors
1981	9.1/4.6	18.0/13.8	3.07/ -.35
1982	9.9/3.6	16.9/10.9	32.82/ 21.22
1983	10.4/3.8	17.5/10.7	7.18/ 30.21
1984	10.0/4.5	18.1/13.6	7.78/ .75
1985	10.4/3.9	15.6/11.6	45.13/ 24.13
1986	13.1/4.1	23.6/11.6	27.90/ 15.50
1987	13.2/5.1	22.7/14.4	11.70/ 6.80
1988	13.5/5.5	22.6/16.2	14.70/ 14.10
1989	13.0/4.7	25.5/15.0	37.60/ 17.50
1990	13.6/4.1	26.4/13.0	19.30/-10.20

Source: Fortune, various issues.

TABLE 1-15

RANK OF THE PHARMACEUTICAL INDUSTRY
(PROFITABILITY)
AMONG 26 INDUSTRIES

Year	Sales	Equity	Investors
1981	2	3	12
1982	1	1	11
1983	1	2	21
1984	1	3	6
1985	1	6	4
1986	1	1	6
1987	1	1	7
1988	1	1	16
1989	1	1	5
1990	1	1	1

Source: Fortune, various issues.

The risks involved in the research process are highlighted by the uncertainty about whether large investments in R&D will yield commercially successful products. Risk factors are not adequately taken into account in profitability comparisons based on traditional earnings measures. The U.S. Department of Commerce has noted that "in this respect, some economists have shown that profitability analysis in the pharmaceutical industry is misleading for several reasons. First, the accounting profits or rates of return of an individual project may be significantly higher during the early years of new drug sales. Second, there is a long time lag, five to ten and sometimes many more years, between the investment and the return on the investment.[7]"

TABLE 1-16

COMPARATIVE EARNINGS STATISTICS
EARNINGS AS A PERCENT OF SALES
1973-1990[a]

	Before Taxes		After Taxes	
Year	Pharmaceutical Industry	All Manufacturing	Pharmaceutical Industry	All Manufacturing
1973	17.8	8.0	10.2	4.7
1974	19.3	8.7	12.2	5.5
1975[b]	19.3	7.5	12.3	4.6
1976	19.0	8.7	12.2	5.4
1977[b]	19.2	8.7	12.1	5.3
1978	19.1	8.9	12.5	5.4
1979[b]	18.6	8.9	12.9	5.7
1980[b]	18.6	7.7	13.2	4.8
1981[b]	15.6	7.4	10.9	4.8
1982[b]	17.9	5.3	13.1	3.5
1983	19.3	6.3	13.4	4.0
1984	19.1	7.1	13.3	4.6
1985	14.6	5.9	9.8	3.8
1986	20.7	5.8	14.5	3.7
1987	15.8	7.3	10.5	4.9
1988	20.8	8.2	16.0	5.9
1989	20.5	6.9	15.4	5.0
1990	20.7	5.7	15.9	4.0

[a] Ratios were calculated using fourth quarter reports.
[b] First quarter reports for the succeeding year were used to calculate these ratios.

Source: Quarterly Financial Report (for manufacturing, mining, and trade corporations), 1970--First Quarter 1982, U.S. Federal Trade Commission; Second Quarter, 1982-1990, U.S. Department of Commerce.

[7] A Competitive Assessment of the U.S. Pharmaceutical Industry, International Trade Administration, U.S. Department of Commerce, December, 1984.

TABLE 1-17

COMPARATIVE EARNINGS STATISTICS
EARNINGS AS A PERCENT OF STOCKHOLDERS' EQUITY
1973-1990[a]

Year	Before Taxes		After Taxes	
	Pharmaceutical Industry	All Manufacturing	Pharmaceutical Industry	All Manufacturing
1973	33.1	21.8	19.0	12.8
1974	29.7	23.3	18.8	14.9
1975[b]	27.8	18.9	17.8	11.6
1976	28.2	22.7	18.1	14.0
1977[b]	28.9	23.2	18.2	14.2
1978	28.6	24.5	18.8	15.0
1979[b]	27.9	25.7	19.3	16.5
1980[b]	27.9	22.0	19.9	14.0
1981[b]	24.2	21.4	16.9	13.7
1982[b]	27.0	14.1	19.7	9.3
1983	29.2	16.4	20.3	10.6
1984	28.9	19.1	20.2	12.4
1985	22.5	15.8	15.2	10.1
1986	32.6	14.9	22.9	9.6
1987	26.5	19.0	17.4	12.7
1988	39.6	22.4	30.4	16.0
1989	39.2	19.1	29.4	13.9
1990	35.6	15.4	27.2	10.7

[a] Ratios were calculated using fourth quarter reports.
[b] First quarter reports for the succeeding year were used to calculate these ratios.

Source: Quarterly Financial Report (for manufacturing, mining, and trade corporations), 1970--First Quarter 1982, U.S. Federal Trade Commission; Second Quarter, 1982-1990, U.S. Department of Commerce.

EMPLOYMENT

In 1989 PMA member firms employed 340,850 persons worldwide. Employment abroad by U.S. firms represented 43.3 percent of the worldwide figure in 1988, but increased to 45.5 percent in 1989 (Table 1-18). Table 1-19 shows the distribution of pharmaceutical employees in the U.S.

TABLE 1-18

U.S. ETHICAL PHARMACEUTICAL INDUSTRY EMPLOYMENT
1988 AND 1989

	Number of Workers	
	1988	1989
United States	179,420	185,900
Foreign	136,820	154,950
TOTAL	316,240	340,850

Source: PMA Annual Survey

TABLE 1-19

ETHICAL PHARMACEUTICAL EMPLOYMENT IN THE U.S.
1988 AND 1989

	1988	1989
Production Workers	59,320	60,300
Marketing	51,500	55,500
Medical Research & Development	41,520	43,620
Administrative	19,810	19,410
Distribution & Other	7,270	7,070
TOTAL U.S. Employment	179,420	185,900

Source: PMA Annual Survey

PRODUCTIVITY

Employees in the pharmaceutical industry have increased productivity faster than employees engaged in other lines of business. From 1977 to 1989, pharmaceutical productivity increased 15 percent. For all non-farm businesses, the increase was 11 percent.

TABLE 1-20

INDEXES OF PRODUCTIVITY
U.S. PHARMACEUTICAL INDUSTRY AND U.S. PRIVATE NON-FARM BUSINESS
1972-1990

(1977 = 100)

	Index of Output (Production) Per Employee Hour	
Year	Pharmaceutical Industry	Non-Farm Business
1972	86.8	94.1
1973	84.8	95.9
1974	90.3	94.1
1975	92.5	96.2
1976	98.4	98.5
1977	100.0	100.4
1978	98.5	101.3
1979	105.3	99.8
1980	106.0	99.6
1981	104.2	100.4
1982	107.0	100.0
1983	114.3	103.3
1984	116.4	105.1
1985	118.1	106.3
1986	121.8	108.5
1987	120.9	109.6
1988	116.8	112.4
1989	114.8	111.5
1990	Not Available	110.5

Source: Office of Publications, U.S. Bureau of Labor Statistics, U.S. Department of Labor, (various statistical series).

CHAPTER II

THE INDUSTRY'S COMMITMENT TO RESEARCH AND DEVELOPMENT

RESEARCH AND DEVELOPMENT EXPENDITURES

The pharmaceutical industry has invested over $40 billion in pharmaceutical research and development (R&D) since the early 1940s. This research commitment led to the discovery of more than 1,200 new chemical entities that have helped prevent disease, cure illness, prolong life and reduce the cost of being sick. Total worldwide R&D spending by PMA member companies was $7.3 billion in 1989. Spending for 1990 is estimated at $8.1 billion. Spending for 1991 is projected at $9.2 billion. These figures include spending for both human-use and veterinary products.

Research by U.S. firms abroad accounted for $1,309 million in 1989--17.9 percent of the total amount. For 1990, U.S. R&D abroad was estimated at $1.5 billion or 18.3 percent of total R&D spending (Figure 2-1). In 1970, research abroad represented only eight percent of total R&D spending by U.S. firms.

Companies finance almost all of their R&D, although they also conduct a very limited amount of research under contract with the federal government. Over the last 17 years, these government-funded projects involved annual expenditures ranging as high as $11 million. In 1989, federally-financed R&D amounted to $2.1 million, or less than one percent of the industry total. The estimated total for federal funds in 1990 was $2.9 million.

R&D-TO-SALES RATIO

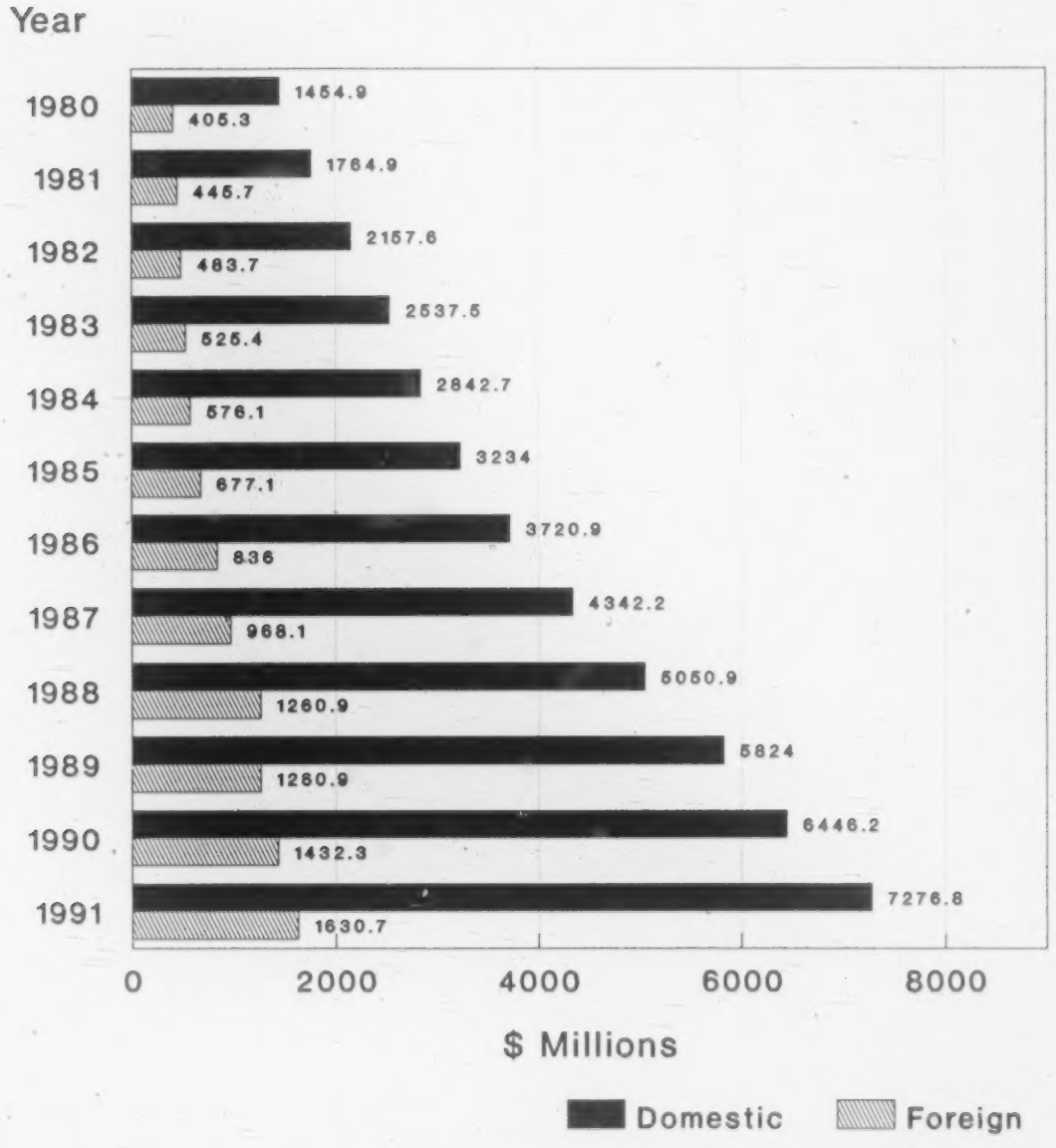
A key measure of the industry's continued commitment to research is the ratio of annual R&D expenditures to dollar volume of pharmaceutical sales. Expressed as a percentage, the ratio has been above ten percent each year since 1968 and since 1980 has increased by 44 percent from 11.7 percent to an estimated 16.9 percent in 1991 (Table 2-1).

ALLOCATION OF RESEARCH FUNDS

Allocation to Product Innovation. In 1989, 83 percent of U.S. R&D expenditures were devoted to the quest for new scientific knowledge and the development of new therapies. Improvement of existing products represented the remaining 17 percent.

FIGURE 2-1

R & D Expenditures for Human Use Ethical Pharmaceuticals, 1980-1991 ($ millions)



1990-91 data are estimated or projected.

TABLE 2-1
U.S. PHARMACEUTICAL R&D EXPENDITURES
AS A PERCENTAGE OF U.S. PHARMACEUTICAL SALES*

1969-1991

YEAR	PERCENT	YEAR	PERCENT
1969	11.1	1981	13.1
1970	11.6	1982	13.8
1971	12.1	1983	14.4
1972	11.8	1984	14.4
1973	11.4	1985	14.8
1974	11.3	1986	14.8
1975	11.6	1987	15.8
1976	11.3	1988	16.3
1977	11.3	1989	16.5
1978	11.1	1990**	16.5
1979	11.4	1991***	16.9
1980	11.7		

* Includes U.S. sales plus exports.
** Estimated
*** Projected
Source: PMA Annual Survey Report.

ALLOCATION BY PRODUCT CLASS

Survey data for 1989 show that the pharmaceutical industry targets its research and development on major health problems. For example, about 69 percent of U.S. R&D expenditures were directed to finding new drugs to treat cardiovascular diseases, infections, neoplasms and central nervous system problems. Expenditures were highest for drugs acting on the cardiovascular system and neoplasms.

Table 2-2 shows the allocation of funding among all product classes, with each class representing drugs useful against a common set of health problems, symptoms, or diseases.

FOREIGN RESEARCH AND DEVELOPMENT

Since 1967, the share of U.S. company-funded R&D work carried out overseas by U.S. firms more than doubled. One reason for this is that costs are lower in some other countries. Another factor is the lengthy approval process for new drugs in the U.S. All major countries have strict rules for approving new pharmaceutical products, but few, if any, countries take as long as the U.S.

Table 2-3 shows the recent trend in foreign research expenditures by domestic firms. Figure 2-2 shows graphically the historical shift of research activity from the U.S. to foreign countries.

TABLE 2-2
U.S. PHARMACEUTICAL R&D EXPENDITURES BY PRODUCT CLASS
1988 - 1989

Ranking 1988	Ranking 1989	Product Class	Percentage Share of R&D Dollar 1988	1989
1	1	Cardiovasculars	25.1%	23.0%
2	3	Neoplasms, Endocrine System & Metabolic Diseases	18.5	15.2
3	2	Central Nervous System & Sense Organs	4.6	15.4
4	4	Anti-infectives	3.9	15.0
5	5	Respiratory	5.4	6.1
6	7	Gastrointestinal & Genitourinary System	4.1	4.6
7	6	Biologicals	4.1	4.7
8	8	Dermatologicals	2.1	2.3
9	9	Diagnostic (in vivo)	.7	2.0
		Other Human Use Drugs	7.8	8.0
		Veterinary Preparations	3.2	3.3
		Veterinary Biologicals	.3	.2
10	10	Vitamins	.2	.2
			100.0%	100.0%

Source: PMA Annual Survey Report.

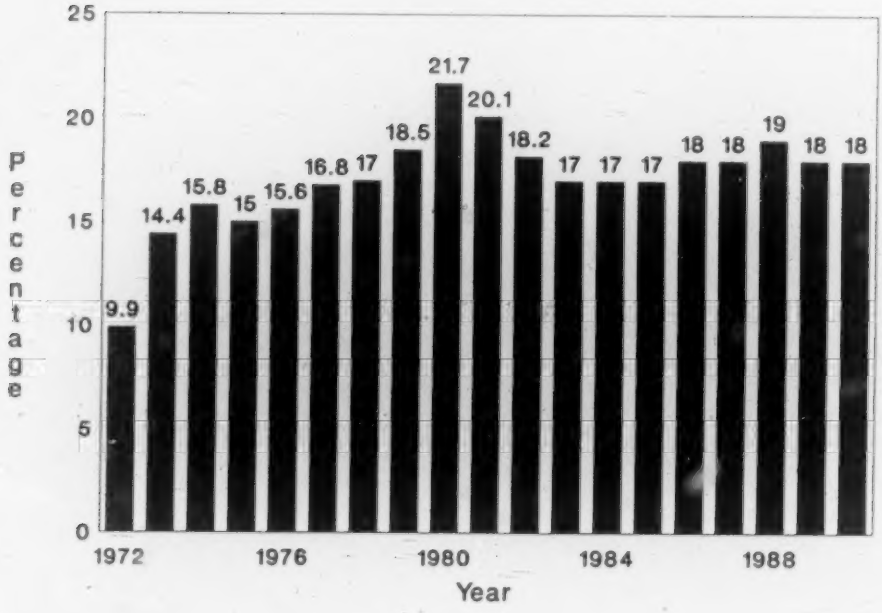
TABLE 2-3
R&D EXPENDITURES OF U.S. COMPANIES IN FOREIGN COUNTRIES
1987-1990
($ Millions)

	1987	1988	1989	1990*
Spent within firms:				
Human Use	$783.1	$1,019.3	$ 984.0	$1,109.3
Veterinary Use	27.8	37.3	39.0	46.9
Spent outside firms:				
Human Use	185.0	241.6	276.9	323.0
Veterinary Use	2.2	5.4	8.7	7.1
Total Expenditures:				
Human Use	968.1	1,260.9	1,260.9	1,432.3
Veterinary Use	30.0	42.7	47.7	54.0
Grand Total:				
Human and Veterinary	998.1	1,303.6	1,308.6	1,486.3

* Budgeted.

FIGURE 2-2

Percentage of U.S. Company-Funded
R & D Conducted Abroad
1972-1990*



* Estimated

NEW DISCOVERY

Introduction of New Products in the United States. Since 1940, 1,265 new single-chemical entities (NCEs) have been introduced into the U.S. market. The annual number of introductions since 1962 has been only about one-third to one-half of the levels achieved during the 1950s (Table 2-4).

Changes in the regulatory process since the late 1950s have increased the time needed to test new drugs. Twelve years elapse between the discovery of a new drug and FDA approval for marketing. This compares with an average of approximately two years prior to the 1962 Amendments to the Food, Drug, and Cosmetic Act.

As the development time for new drugs has increased, so has the cost of R&D per new drug introduced. A large part of industry R&D expenditures, including basic research and the cost of development for projects that must be abandoned for reasons of lack of effectiveness or excessive risks, cannot be allocated to specific products. For this reason, it is difficult to estimate the full R&D costs for a specific product.

TABLE 2-4

NEW SINGLE ENTITY DRUG INTRODUCTIONS TO U.S. MARKETS
1940-1990

Year	Number of Entities	Year	Number of Entities
1940	14	1966	13
1941	17	1967	25
1942	13	1968	12
1943	10	1969	9
1944	13	1970	16
1945	13	1971	14
1946	19	1972	10
1947	26	1973	17
1948	29	1974	18
1949	38	1975	15
1950	32	1976	14
1951	38	1977	16
1952	40	1978	23
1953	53	1979	15
1954	42	1980	13
1955	36	1981	19
1956	48	1982	26
1957	52	1983	22
1958	47	1984	15
1959	65	1985	20
1960	50	1986	24
1961	45	1987	20
1962	24	1988	19
1963	16	1989	24
1964	17	1990	24
1965	25		
		TOTAL:	1,265

Source: PMA Analysis of Paul De Haen data.

Table 2-5 summarizes the results of six studies that examined the costs of discovering and developing new products in the pre-1962 and post-1962 periods, excluding the costs of capital. These studies document the substantial increase in the cost of bringing new drugs to market. The studies show that post-1962 costs averaged about seven times pre-1962 costs.

TABLE 2-5
RESEARCH AND DEVELOPMENT COSTS* PER NCE DRUG
PRE-1962 VS. POST-1962**
(1980 Dollars)

	Pre-1962 ($ Million)	Post-1962 ($ Million)
Schwartzman	$3.7	$48.6
Sarett	3.4	25.9
Mansfield/Schnee	3.1	-
Clymer	-	56.5
Hansen	-	47.6
Baily	16.0	-

* Excluding the cost of capital.
** Studies examined drugs approved from 1963 through 1975.
Source: Hutt, Peter Barton, The Importance of Patent Term Restoration to Pharmaceutical Innovation, Health Affairs, Spring, 1982.

The study by Hansen is of particular interest. He used an accounting approach and studied R&D expenditures for a sample of new drugs from 1963 through 1975. Because R&D expenditures for a new drug are made over a period of years, these expenditures were capitalized in the study. Hansen found an average cost of $54 million (1976 dollars), including the cost of capital.

Hansen also considered the costs for the major phases of the R&D process--preregulatory and regulatory. The regulatory phase begins with the Investigational New Drug (IND) Exemption required to begin tests in human beings. Hansen estimated that pre-IND expenditures are about equal to those incurred during the post-IND phase.

A study by Steven Wiggins at Texas A&M University, based on new chemical entities approved between 1970 and 1985, estimates that the total cost for an approved new drug is $125 million in 1986 dollars.[1] Like the Hansen study, this analysis accounts for the opportunity costs of investing funds several years before a drug can be marketed. The increasing cost of developing a new drug is in part attributable to the increasing research focus on chronic conditions. Drugs intended to treat these conditions require more extensive testing.

New study results announced by the Center for the Study of Drug Development at Tufts University estimate that it takes an average of $231 million and 12 years to develop a new drug. This study uses new data on 93 randomly selected drugs. Like the earlier Wiggins and Hansen studies, opportunity costs are included in the analysis.[2]

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1 Wiggins, Steven N., The Cost of Developing a New Drug, PMA, 1987.

2 DiMasi et.al., The Cost of Innovation in the Pharmaceutical Industry: New Drug R&D Cost Estimates, 1990.

NEW DRUG INTRODUCTIONS: U.S. VS. FOREIGN

Table 2-6 lists for each year the number of introductions by country where the headquarters of the company or institution developing the new drugs were located. A total of 1,715 drugs were introduced from 1963 through 1990. U.S. companies were responsible for 399 or 23.0 percent of the total.

Drug introductions by country where each new drug was first marketed are shown in Table 2-7. The results show that only 6.3 percent of the 1,715 new drugs were marketed first in the U.S., 18.0 percent were first introduced in France, 12.9 percent in West Germany, and 15.8 percent in Japan. In 1990, nearly one-third of the new drugs introduced were marketed first in Japan.

A similar study[3] conducted by the U.S. Food and Drug Administration examined annual introductions of original molecules in five countries--France, Germany, Italy, the United Kingdom, and the U.S. The study concluded that about 32 percent of all new drugs introduced in the five countries eventually are marketed in the U.S. About 46 percent of the drugs are introduced in the U.K., while France, Italy and Germany each get 60 to 70 percent of the total number of drugs introduced in the five countries.

The FDA study also looked at the "drug lag" in the five countries--i.e., the length of time that elapses between first introduction of a drug and its introduction in another country. For drugs first introduced between 1960 and 1962, approximately 1.7 years elapsed on average before introduction in the U.S. market. The lag time in the U.S. increased to four years for drugs introduced in the late 1960s, but declined in the early 1970s to about 2.2 years--a figure consistent with the experience for France, Germany and the U.K.

NEW DRUGS, 1940-1990

The long-standing leadership of the U.S. in drug innovation is reflected by the fact that about 61 percent of the new chemical entities introduced in the country since 1940 were U.S. discoveries (Table 2-8). In the U.S. over 90 percent of the new drugs were discovered by private industry.

Table 2-9 shows the distribution of introductions by therapeutic class. Since 1940, the therapeutic class that had the largest number of new chemical entities introduced was anti-infectives, with a total of 231 products.

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[3] A Historical Look at Drug Introductions on a Five-Country Market, OPE Study 60, Food and Drug Administration, March, 1982.

TABLE 2-6
NEW DRUG INTRODUCTIONS BY YEAR AND COUNTRY OF ORIGIN
1963-1990

Year of Introduction	U.S.	France	West Germany	Japan	Italy	Switzerland	Eastern Block	Great Britain	Other Countries(a)	Annual New Introductions
1963	22(1)	21	17(1)	12	2	7	2	9	8	99
1964	15	8	14	8	4	6	5	4	6	70
1965	13	14	10	13	6	7	2	4	4	73
1966	22	19	7	8	3	3	8	4	10	84
1967	20(1)	19	8	7	5	8	9	5(1)	7	87
1968	20(2)	17(1)	12(1)	7	7(1)	5(1)	5	4	10	84
1969	18(1)	23	11	5	9	3	9	3(1)	5	85
1970	21(1)	18	7(1)	7	1	6	4	2	6	71
1971	25	16	5	11	7	6	9	2	10	91
1972	14	13	4	9	9	3	8	3	4	67
1973	10	18	14(1)	1	8	9(1)	9	3	6	77
1974	17(1)	13	9(1)	14	4	5	4	4	8	77
1975	15	7	12	8	5	8(1)	11	4	4(1)	73
1976	17(1)	8	9(1)	2	7	2	5	3	8	60
1977	14	6	13	7	11	3	1	6	6	67
1978	12	10	7(1)	7	4	4(1)	2	4	5	54
1979	14	6	7	7	7	-	1	-	3	45
1980	13(1)	2	9(1)	11(1)	9	4(2)	-	-	3(1)	48
1981	(data not available for 1981)									
1982	8	5	1	10	3	4	1	-	7	39
1983	10	3	9	8	1	4	-	2	2	39
1984	7	[illegible]	1	11	5	4	-	2	2	37
1985	18	4	4	14	6	1	-	3	3	53
1986	15(3)	3	7	17(2)	2	-	-	3	3(1)	47
1987	10(1)	6	1	18	5	5(1)	-	4	10	58
1988	12	8	2	14	4	3	1	2	6	52
1989	8(1)	2	3	11(1)	-	2	-	4	6	35
1990	9	1	3	10	2	3	-	8	7	43
Total	399	275	206	257	136	115	96	92	159	1,715
	(14)	(1)	(8)	(4)	(1)	(7)		(2)	(3)	

a Argentina, Australia, India, Canada, Portugal, Scandinavia, Benelux, Spain, Austria, and Finland.

Note: Figures in parentheses signify substances developed simultaneously in two countries. The figure in parentheses is always included in the preceding number of substances.

Source: E. Reis-Arndt, Medical Marketing & Media (August 1983): 12 (1961-1980 figures); and "World Drug Introductions," Scrip, various issues (1982-1990 figures). No 1981 figures were available.

TABLE 2-7

NUMBER OF NEW DRUGS, BY YEAR AND COUNTRY OF FIRST MARKETING
1963-1990

Year of Introduction	France	West Germany	Japan	Great Britain	Italy	U.S.	Eastern Block	Switzerland	Other Countries(a)	Annual First Introductions
1963	20	24	12	17	2	7	2	6	9	99
1964	16	14	5	7	1	7	5	4	11	70
1965	16	14	13	4	6	4	2	4	10	73
1966	24	12	8	8	3	6	8	1	14	84
1967	19	12	11	10	7	5	9	5	9	87
1968	19	15	7	11	4	2	5	4	17	84
1969	25	13	7	7	8	3	8	2	13	85
1970	21	6	8	4	5	6	4	4	13	71
1971	15	5	11	8	7	6	9	6	24	91
1972	14	4	9	7	9	4	8	2	10	67
1973	21	6	2	6	6	6	9	4	17	77
1974	14	5	15	11	5	4	3	4	16	77
1975	10	7	8	5	8	3	10	8	14	73
1976	9	5	2	6	6	2	5	2	23	60
1977	4	18	7	7	13	3	1	3	9	67
1978	15	7	7	6	4	3	2	3	7	54
1979	9	7	7	3	7	4	1	1	6	45
1980	1	13	10	6	7	-	-	3	8	48
1981 (Data not available for 1981).										
1982	6	3	9	3	1	4	1	4	8	39
1983	3	8	7	5	3	1	-	5	7	39
1984	5	4	12	1	5	2	-	3	5	37
1985	5	8	14	4	6	3	-	2	11	53
1986	1	6	23	4	2	6	-	1	4	47
1987	6	1	19	5	5	5	-	4	13	58
1988	7	1	14	4	5	2	-	3	16	52
1989	3	2	12	4	-	4	-	-	10	35
1990	1	1	12	7	2	7	-	1	12	43
Totals	309	221	271	170	137	109	92	89	317	1,715

a Argentina, Australia, Austria, Benelux (Holland, Belgium), Brazil, Canada, Iran, Colombia, Hong Kong, Ireland, Luxembourg, Malaysia, Mexico, New Zealand, Philippines, Portugal, Scandinavia (Sweden, Denmark), South Africa, Spain, Zambia, Israel, Pakistan.

Source: Medical Marketing and Media, August, 1983, p.16; "World Drug Introductions", Scrip various issues (1982-1990 figures).

THE FDA PRE-MARKETING DRUG APPROVAL PROCESS

Before a new drug can be marketed in the U.S., extensive testing must be performed and the FDA must approve the products as being "safe and effective" for its intended uses. Tests begin with animals. If a drug is determined to be safe for limited, controlled clinical trials in humans, a sponsor must submit an Investigational New Drug (IND) application to inform the FDA that efficacy and safety studies in man will be initiated within 30 days unless the FDA objects.

Clinical studies of a new drug in humans are usually divided into three phases. Phase I is an initial, cautious trial in a few healthy persons; Phase II deals with more detailed observations in research subjects who have the disease for which the drug is intended to be effective; Phase III consists of more extensive, often longer tests to ascertain whether the drug is effective for the disease state or syndrome it is intended to treat.

If clinical testing proceeds, substantial record keeping is required throughout the testing period. A sponsor then submits a New Drug Application (NDA) containing documentation of safety and effectiveness studies and manufacturing control procedures to be used in preparing the product.

The attrition rate for prospective new chemical entities as a result of clinical testing is very high. Approximately only one in five drugs for which INDs are issued go through all clinical phases of investigation. Table 2-10 shows the number of INDs and NDAs filed from 1963 through 1990. The annual number of INDs submitted during this period varied between 671 and 2,112. About half of the INDs submitted are abandoned by the sponsor, usually a pharmaceutical company. Discontinuances usually are based on company evaluations of test results and of the potential of the drug being tested.

PATENT ACTIVITY

Patent activity is another measure of the intensity of pharmaceutical research. A new drug may be the subject of several different patents. Patents may be obtained for new chemical entities, for novel manufacturing processes and for new uses of existing compounds. Tables 2-11, 2-12, and 2-13 show the number of patents issued for drugs and medicines during 1963-1989 and the countries in which the companies that received patents were based. The relative share of patents that were issued for "Drugs and Medicines" to companies based in the U.S. was almost two-thirds from 1963-1975, but declined to 51 percent in 1989.[4]

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[4] The U.S. Patent Office credits patents to the country of residence shown by the inventor on the patent applications.

TABLE 2-8

NEW SINGLE CHEMICAL ENTITY DRUGS INTRODUCED TO U.S. MARKET
BY COUNTRY OF ORIGIN
1940 - 1990

Country of Origin	Solely National Origin (A)	Shared Products (B)[a]	Equivalent Number (C)[b]	Accredi-tation (A+C)	Percentage of Total 1265 New Drugs
United States	759	10	5.0	764.0	60.4%
Switzerland	87	4	2.0	89.0	7.0
United Kingdom	80	3	1.5	81.5	6.4
West Germany	71	4	2.0	73.0	5.8
France	39	1	0.5	39.5	3.1
Denmark	17	1	0.5	17.5	1.4
Belgium	23			23.0	1.8
Sweden	18	1	0.5	18.5	1.5
Holland	15			15.0	1.2
Japan	26	1	0.5	26.5	2.1
Mexico	9	2	1.0	10.0	0.8
Italy	13	1	0.5	13.5	1.0
Austria	3			3.0	0.2
Canada	5			5.0	0.4
Australia	2			2.0	0.2
Hungary	4			4.0	0.3
Czechoslovakia	1	1	0.5	1.5	0.1
Argentina	1			1.0	0.1
India	1			1.0	0.1
Norway	1			1.0	0.1
Europe (specific nation unknown)	0	1	0.5	0.5	0.0
Source not ascertained	75	—	—	75.0	6.0
TOTAL	1250	30	15.0	1265	100.0%

[a]Column B lists the number of drugs for which a country shared the credit with one or more other countries in the origination of a chemical entity.
[b]Equivalent Number (column C) assigns one-half credit for each shared product introduction under column B, i.e., column B divided by two.

Source: PMA Analysis of Paul De Haen data.

TABLE 2-9

NEW SINGLE CHEMICAL ENTITIES INTRODUCED TO U.S. MARKET
BY THERAPEUTIC CLASS

1940-1990

Therapeutic Class	No. in Group	No. in Subgroup	Percentage
ANALGESICS	39		3.0%
Migraine Therapy		3	
Narcotics		18	
Nonnarcotics		18	
ANALEPTICS	3		0.2
ANTAGONISTS AND ANTIDOTES	21		1.7
Antagonists		5	
Antidiuretics		2	
Antidotes			
Antineoplastics		12	
Nonspecified		2	
ANESTHETICS	30		2.4
Inhalants		5	
Injectables		9	
Local and Topical		16	
ANTHELMINTICS	13		1.0
ANTI-ARTHRITICS (NONHORMONAL)	13		1.0
ANTICOAGULANTS	14		1.1
ANTICONVULSANTS	16		1.3
ANTIHISTAMINES	38		3.0
ANTI-INFECTIVES	231		18.3
General		1	
Amoebicides		9	
Antibacterials			
General		14	
Urinary		11	
Vaginal		8	
Antibiotics			
Broad and Medium Spectrum		66	
Penicillin and Derivatives		39	
Topical		6	
Unclassified		3	
Antimalarials		9	
Antitubercular		17	
Fungicides--Systemic		8	
Sulfonamides		33	
Antiparasitics		6	
Tropical Diseases--General		1	
ANTI-INFLAMMATORY AGENTS (nonhormonal)	15		1.2
ANTINAUSEANTS	12		.9
ANTI-OBESITY PREPARATIONS	17		1.3
Amphetamines		10	
Other		7	

TABLE 2-9
(Continued)

NEW SINGLE CHEMICAL ENTITIES INTRODUCED TO U.S. MARKET
BY THERAPEUTIC CLASS
1940-1990

Therapeutic Class	No. in Group	No. in Subgroup	Percentage
ANTIVIRALS	5		.4
ATARAXICS	58		4.6
BRONCHODILATORS	16		1.3
CANCER CHEMOTHERAPY	46		3.6
IMMUNOSUPPRESSANTS	2		0.2
CARDIOVASCULAR PREPARATIONS	109		8.6
Anti-arrhythmics		14	
Cardiotonics		4	
Hypertensives		7	
Hypotensives		38	
Alkaloids		14	
Vasoconstrictors		1	
Vasodilators			
Coronary		8	
Microcirculatory		2	
Peripheral		9	
Xanthine Derivatives		5	
Other Cardiovasculars		7	
CHOLESTEROL AFFECTING AGENTS	14		1.0
Lipotropics		3	
Other	10		
COAGULANTS	5		0.4
CONVULSANTS	1		0.1
COUGH AND COLD PREPARATIONS	24		1.9
Cough Preparations		12	
Nasal Decongestants		12	
DERMATOLOGIC PREPARATIONS	60		4.7
Antipruritics			
Local		3	
Systemic		2	
Corticoids--Local		19	
Fungicides--Topical		23	
Other		13	
DIABETIC THERAPY	12		0.9
Hypoglycemics		11	
Hyperglycemics		1	
DIURETICS	38		3.0
Benzothiazides		11	
Other		27	
ENZYMES	11		0.9
EYE PREPARATIONS	20		1.6
FERTILITY AGENTS (nonhormonal)	1		0.1

TABLE 2-9
(Continued)

NEW SINGLE CHEMICAL ENTITIES INTRODUCED TO U.S. MARKET
BY THERAPEUTIC CLASS
1940-1990

Therapeutic Class	No. in Group	No. in Subgroup	Percentage
GASTROINTESTINAL PREPARATIONS	79		6.2
Antacids		9	
Antidiarrheals		5	
Antispasmodics		38	
Biliary Tract Therapy		4	
Enemas	2		
Enzymes--Digestive		1	
Laxatives		6	
Other G.I. Preparations		14	
HEMATINICS	16		1.3
HEMOSTATICS	2		0.2
HORMONES	91		7.2
ACTH		2	
Anabolics (Hormonal)		9	
Androgens		6	
Corticoids		33	
Estrogens		21	
Progesterones		11	
Other Hormones		9	
HOSPITAL SOLUTIONS	8		0.6
MUSCLE RELAXANTS	38		3.0
General		16	
Parkinsonism		12	
Surgical		10	
OXYTOCICS	5		0.4
PARASYMPATHOMIMETICS	7		0.6
PSYCHOSTIMULANTS	27		2.0
SEDATIVES AND HYPNOTICS	24		1.9
Barbiturates		6	
Nonbarbiturates		18	
THYROID THERAPY	9		0.7
Thyroid Preparation		5	
Antithyroid Preparations		4	
VITAMINS AND NUTRIENTS	16		1.3
Vitamins		10	
Nutrients		6	
UNCLASSIFIED	59		4.7
TOTAL	1265		100.0%*

*May not add due to rounding.
Source: PMA Analysis of Paul De Haen data.

TABLE 2-10

NEW DRUG FILINGS WITH FOOD AND DRUG ADMINISTRATION
1963-1990

Year	Original INDs Submitted	INDs Discontinued by Sponsor	Original NDAs Submitted	NDAs Approved	New Molecular Entities*
1963	1066	6	192	71	16
1964	875	215	160	70	20
1965	761	306	221	50	13
1966	715	580	216	50	17
1967	671	627	128	74	16
1968	859	564	108	56	11
1969	956	482	60	39	11
1970	1127	N.A.	87	53	11
1971	923	1167	256	68	14
1972	902	452	272	42	10
1973	822	311	149	77	14
1974	802	399	129	95	23
1975	876	472	137	68	15
1976	855	524	127	101	23
1977	925	802	124	63	21
1978	925	588	121	86	22
1979	940	539	182	94	14
1980	1087	626	162	114	12
1981	1184	353	129	96	27
1982	1467	689	202	116	28
1983	1798	N.A.	269	94	14
1984	2112	N.A.	217	142	22
1985	1904	N.A.	148	100	30
1986	1623	N.A.	120	98	20
1987	1346	N.A.	142	69	21
1988	1337	N.A.	126	67	20
1989	1345	N.A.	118	87	23
1990	1530	N.A	98	64	23

* FDA's definition of new molecular entities differs from the definition of new chemical entities by Paul De Haen, Inc., a key source for PMA's analysis of new drug introductions and the one used in this book. PMA omits diagnostic agents, although the FDA count of new molecular entities includes these agents. In addition, FDA uses application approval dates, whereas De Haen and PMA use year of introduction to the market. Thus, new molecular entities indicated here for a given year may be based on INDs and NDAs submitted a year or more earlier.

N.A.: Not Available.

Source: Unpublished data, Bureau of Drugs, Food and Drug Administration, U.S. Department of Health and Human Services. New Drug Evaluation Project, Briefing Book, FDA, May 1982, September 1983, March 1986, April 1987.

TABLE 2-11
NUMBER OF NEW U.S. PATENTS FOR
DRUGS AND MEDICINES
BY ORIGIN
1963 - 1989

	NUMBER OF PATENTS															
	1963-1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	TOTAL
TOTAL	13566	2314	2423	2386	1834	2468	2585	2253	2008	2511	2502	2535	3062	3102	4221	49770
U.S. ORIGIN	8454	1226	1238	1244	924	1225	1322	1064	946	1297	1244	1216	1595	1620	2138	26753
FOREIGN ORIGIN	5112	1088	1185	1142	910	1243	1263	1189	1062	1214	1258	1319	1467	1482	2083	23017
U.S. ORIGIN	8454	1226	1238	1244	924	1225	1322	1064	946	1297	1244	1216	1595	1620	2138	26753
U.S. CORP. OWNED	7515	1126	1120	1129	828	1070	1162	920	808	1126	1107	1056	1396	1447	1862	23672
U.S. GOVT. OWNED	202	26	25	17	18	34	28	26	28	32	27	28	44	37	45	617
U.S. INDIV. OWNED	698	61	86	91	71	111	123	104	99	128	100	118	133	120	205	2248
FOREIGN OWNED	39	13	7	7	7	10	9	14	11	11	10	14	22	16	26	216
FOREIGN ORIGIN	5112	1088	1185	1142	910	1243	1263	1189	1062	1214	1258	1319	1467	1482	2083	23017
U.S. OWNED	832	159	167	164	140	183	146	147	120	109	143	132	140	166	220	2968
FOREIGN OWNED	4280	929	1018	978	770	1060	1117	1042	942	1105	1115	1187	1327	1316	1863	20049
FOREIGN CORP.	3813	873	965	920	721	992	1034	954	883	1022	1042	1109	1233	1212	1736	18509
FOREIGN GOVT.	5	1	2	4	2	4	2	19	13	19	10	9	21	18	20	149
FOREIGN INDIV.	462	55	51	54	47	64	81	69	46	64	63	69	73	86	107	1391

Note: Data on patent counts were prepared under the support of the Science Indicators Unit, National Science Foundation, by the Technology Assessment and Forecast Program, U.S. Patent and Trademark Office.

TABLE 2-12
PERCENTAGE OF U.S. PATENTS FOR
DRUGS AND MEDICINES
BY ORIGIN
1963 - 1989

	NUMBER OF PATENTS															
	1963-1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	TOTAL
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
U.S. ORIGIN	62	53	51	52	50	50	51	47	47	52	50	48	52	52	51	54
FOREIGN ORIGIN	38	47	49	48	50	50	49	53	53	48	50	52	48	48	49	46
U.S. ORIGIN	62	53	51	52	50	50	51	47	47	52	50	48	52	52	51	54
U.S. CORP. OWNED	55	49	46	47	45	43	45	41	40	45	44	42	46	47	44	48
U.S. GOVT. OWNED	2	1	1	1	1	2	1	1	1	2	1	1	1	1	1	1
U.S. INDIV. OWNED	5	3	4	4	4	5	5	5	5	5	4	5	4	4	5	5
FOREIGN OWNED	*	*	*	*	*	*	*	*	1	*	*	*	1	*	1	*
FOREIGN ORIGIN	38	47	49	48	50	50	49	53	53	48	50	52	48	48	49	46
U.S. OWNED	6	7	7	7	8	7	6	7	6	4	6	5	5	6	5	6
FOREIGN OWNED	32	40	42	41	42	43	43	46	47	44	44	47	43	42	44	40
FOREIGN CORP.	28	38	40	39	39	40	40	42	44	41	42	44	40	39	41	37
FOREIGN GOVT.	1	*	*	*	*	*	*	1	1	1	*	*	1	*	*	*
FOREIGN INDIV.	3	2	2	2	3	3	3	3	2	2	2	3	2	3	3	3

* Less than one percent.
Source: U.S. Patent and Trademark Office

TABLE 2-13
NUMBER OF FOREIGN ORIGIN PATENTS FOR
DRUGS AND MEDICINES
BY COUNTRY
1963-1989

	NUMBER OF PATENTS				
COUNTRY OF ORIGIN	1963-1975	1976-1979	1980-1984	1985-1989	TOTAL
Japan	944	784	1495	2228	5451
West Germany	1127	1099	1294	1561	5081
United Kingdom	567	660	891	1012	3130
France	707	528	582	715	2532
Switzerland	652	392	454	412	1910
Italy	229	170	357	445	1201
Canada	171	124	146	194	635
Sweden	149	101	88	125	463
Netherlands	142	72	103	88	405
Hungary	24	46	130	173	373
Belgium	70	64	105	103	342
Denmark	43	36	40	81	200
Austria	44	28	31	49	152
U.S.S.R.	27	46	38	30	141
Mexico	33	11	11	17	72
Other Countries	183	164	206	376	929
TOTAL	5112	4325	5971	7609	23,017

Source: U.S. Patent and Trademark Office

The pharmaceutical industry is the major source in the U.S. for discovering and developing drug products, and patent protection provides necessary incentives to stimulate investment of millions of dollars in research and development. By providing inventors with an exclusive right for 17 years to sell these inventions in the U.S., patents enable companies to realize adequate returns on their substantial investments. New medicines help to improve the health of people in this country and, therefore, great social benefits result from the patent protection given to the inventors of these products. Patents also stimulate additional research by providing useful data for other research efforts.

A patent application is usually filed as soon as a chemical compound shows promising pharmacological activity. Extensive testing is usually required, however, to determine whether a compound can be developed for practical use as a medicine. Such testing in animals and man--and processing through the IND and NDA phases--often continues for years after a patent has been granted. This reduces the patent-protected marketing time during which a company may recover its investment in the product.

CHAPTER III

THE VALUE OF PHARMACEUTICALS IN IMPROVING HEALTH CARE AND IN REDUCING COSTS OF ILLNESS

Pharmaceutical research helps to improve the health of the population. Decreased morbidity and increased longevity are key measures for such progress. Numerous economic studies document that drugs are a cost-effective form of therapy that can substantially reduce health care costs.

MORBIDITY

Since 1940, the use of drugs and vaccines has substantially reduced the incidence of certain diseases. For example, drug therapy has virtually eliminated diphtheria and polio (Table 3-1).

TABLE 3-1

REDUCTION IN REPORTED U.S. CASES OF SELECTED DISEASES 1940 AND 1989

Disease	1940	1989	Percent Reduction	Form of Treatment or Prevention
Diphtheria	15,536	3	99.9%	Vaccines
Measles	291,162	18,193	93.8	Vaccines
Polio	57,879*	5	99.9	Vaccines
Syphilis	472,900	44,540	90.6	Antibiotics
Tetanus	486	53	89.1	Vaccines
Tuberculosis	102,984	23,495	77.2	Anti-infectives
Typhoid Fever	9,809	460	95.3	Vaccines & Antibiotics
Whooping Cough	183,866	4,157	97.7	Vaccines

* This figure is for 1952; three years before Salk vaccine was introduced.

Source: Morbidity and Mortality Weekly Report, Annual Summary 1989, U.S. Department of Health and Human Services.

Reduction in morbidity--sickness and sick days--has been achieved for other forms of illness. For example, drug therapy has dramatically reduced the number of patients who require hospitalization for tuberculosis. The disease is now treatable at home with para-aminosalicylic acid (PAS), isoniazid, streptomycin, rifampin, and other drugs. A similar result has been achieved through the use of H_2 antagonist drugs for ulcers. Besides reducing the need for hospitalization, drugs also prevent and cure disease, supplement other medical treatment such as surgery, and restore patients to a normal life.

MORTALITY

Medicines also have enabled people to lead longer, healthier lives, as shown by the substantial improvement in mortality rates (Table 3-2). Since 1940, life expectancy has increased by 17.6 percent for men and by 20.1 percent for women (Table 3-3).

COST-EFFECTIVENESS

Studies sponsored by PMA show that drugs not only reduce sickness and save lives, but they also save money. Three studies of cardiovascular beta-blocker drugs show that their benefits far exceed their costs. In preventing second heart attacks, these drugs may save $1.6 billion to $3.0 billion a year.[1] As an alternative to surgery for treating glaucoma, use of a beta-blocker may save $746 million to $1.06 billion annually.[2] In treating angina, use of beta-blockers may save as much as $237 million a year.[3]

TABLE 3-2

MORTALITY: REDUCTIONS IN U.S. DEATHS PER 100,000 POPULATION FROM SELECTED DISEASES
1960 and 1988

Disease	1960	1988	Percent Reduction
Rheumatic Fever and Rheumatic Heart Disease	10.3	2.6	74.7%
Hypertensive Heart Disease	37.0	8.5	77.0
Hypertension	7.1	3.4	52.1
Cerebrovascular Disease	108.0	61.2	43.3
Atherosclerosis	20.0	9.0	55.0
Pneumonia and Influenza	37.3	31.6	15.3
Asthma	3.0	1.9	36.7
Ulcer of Stomach & Duodenum	6.3	2.6	58.7
Infections of Kidneys	4.3	.7	83.7
Tuberculosis (all forms)	6.1	.8	86.9
Meningitis	1.3	.5	61.5

Source: U.S. National Center for Health Statistics, Division of Vital Statistics.

1 Beta Blocker Reduction of Mortality and Reinfarction Rate in Survivors of Myocardial Infarctions: A Cost-Benefit Study, Report 7, A.D. Little, Inc. (1984).

2 Use of a Beta Blocker in the Treatment of Glaucoma: A Cost-Benefit Study Report 8, A.D. Little, Inc. (1984).

3 Use of Beta Blockers in the Treatment of Angina: A Cost-Benefit Study, A.D. Little, Inc. (1984).

TABLE 3-3

U.S. EXPECTATION OF LIFE AT BIRTH
1920-1988

Year	Men	Women	Average
1920	53.6	54.6	54.1
1930	58.1	61.6	59.7
1940	60.8	65.2	62.9
1950	65.6	71.1	68.2
1960	66.6	73.1	69.7
1965	66.8	73.7	70.2
1966	66.7	73.8	70.1
1967	67.0	74.2	70.5
1968	66.6	74.0	70.2
1969	67.0	74.3	70.5
1970	67.1	74.8	70.9
1971	67.4	74.8	71.0
1972	67.4	75.2	71.2
1973	67.6	75.3	71.3
1974	68.1	75.8	71.9
1975	68.7	76.5	72.5
1976	69.0	76.7	72.8
1977	69.3	77.1	73.2
1978	69.4	77.3	73.3
1979	70.0	77.3	73.9
1980	70.0	77.5	73.7
1981	70.4	77.9	74.2
1982	70.9	78.2	74.6
1983	71.0	78.1	74.6
1984	71.2	78.2	74.7
1985	71.2	78.2	74.7
1986	71.3	78.3	74.8
1987	71.5	78.4	75.0
1988	71.5	78.3	74.9

Source: Statistical Abstract (1985), U.S. Department of Commerce. 1983 Life Insurance Fact Book, Telephone Conversations, National Center for Health Statistics.

Another study demonstrates the cost-effectiveness of vaccines against measles, mumps, rubella, pneumococcal pneumonia in high-risk groups, pertussis, adenoviral respiratory infections, polio, and influenza in the elderly.[4] For example, the study reports that the benefits of measles vaccine were more than ten times the costs over a nine-year period.

[4] Benefits and Costs of Human Vaccines in Developed Countries: An Evaluative Survey, Weisbrod and Huston (1984).

A review of the literature[5] also shows the cost-effectiveness of drug therapy. In a study of the preventive use of an antibiotic, for example, the average annual cost of preventing urinary tract infections was found to be $85 per patient, compared to $126 for treating the infection--a savings of 33 percent. In another study, Medicaid expenditures were determined to be approximately 70 percent less for persons using a new anti-ulcer drug than for those not receiving the medicine. And a third study concluded that treating mental patients with an anti-psychotic drug was the least costly of five forms of therapy--lower by 26.1 percent to 62 percent--and was one of the most effective methods of treatment.

5 Economic Evaluations of Medicines: A Review of the Literature, Judith L. Wagner (1984).

CHAPTER IV

TODAY'S HEALTH CARE ENVIRONMENT

The provision of health services and products is a major industry in the United States: expenditures for these goods and services represent over one-tenth of total annual spending for all goods and services. The rate of growth of these expenditures continues to outpace that of the gross national product (GNP).

Despite this growth in overall expenditures, the proportion of health expenditures for non-hospital drugs and medical sundries[1] has been declining and now represents only 7.4 percent of total health care expenditures. The relative cost of drugs, in other words, is shrinking in comparison with other medical expenditures.

NATIONAL HEALTH EXPENDITURES

The nation spent $604 billion for health care in 1989, an average of $2,354 per person. During the past 60 years, the health care industry has steadily expanded its share of the GNP, from 3.6 percent in 1929 to 11.6 percent in 1989 (Table 4-1).

Table 4-2 shows the major components of national health expenditures. Hospital care represents the largest category of health expenditures: in 1989, hospitals accounted for $233 billion, nearly 40 percent of all health care costs.

While total health expenditures have increased steadily over the last 25 years, drugs and medical sundries have consistently declined from 14.2 percent of national health expenditures in 1965 to 7.4 percent in 1989 (Table 4-3).

In recent years, general inflation in the economy as a whole has been the most important cause of increasing health care expenditures. Between 1980 and 1989, general inflation accounted for 44 percent of health care expenditure growth, increased services per capita accounted for 26 percent, population growth caused 9 percent, and excess health care sector inflation was responsible for 21 percent.

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[1] The category "Drugs and Medical Sundries" is used by the U.S. Health Care Financing Administration as a subcategory of health expenditures and is derived in part from U.S. Department of Commerce calculations of personal consumption expenditures. The term encompasses prescription and over-the-counter drugs and sundries. This total does not include hospital drug expenditures. Prescription drugs are estimated to account for 60 percent of the total spent on drugs and medical sundries, according to the Health Care Financing Administration.

TABLE 4-1

NATIONAL HEALTH EXPENDITURES, AGGREGATE, PER CAPITA
AND PERCENT OF GROSS NATIONAL PRODUCT
Calendar Years 1929-1989
(Current $)

Year	Gross National Product (in billions)	National Health Expenditures Amount (in billions)	Health Expenditures Per Capita	Health Expenditures Percent of GNP
1929	$ 103.40	$ 3.60	$ 29.00	3.6%
1940	100.00	4.00	30.00	4.0
1950	286.50	12.70	82.00	4.4
1955	400.00	17.70	105.00	4.4
1960	515.00	27.10	143.00	5.3
1965	705.00	41.60	204.00	5.9
1966	772.00	45.90	222.00	5.9
1967	816.00	51.70	248.00	6.3
1968	893.00	58.50	278.00	6.6
1969	964.00	65.70	309.00	6.8
1970	1,015.00	74.40	346.00	7.3
1971	1,103.00	82.30	379.00	7.5
1972	1,213.00	92.30	421.00	7.6
1973	1,359.00	102.50	464.00	7.3
1974	1,473.00	116.10	521.00	7.9
1975	1,598.00	132.90	592.00	8.3
1976	1,783.00	152.20	672.00	8.5
1977	1,991.00	172.00	753.00	8.6
1978	2,250.00	193.40	838.00	8.6
1979	2,508.00	216.60	930.00	8.6
1980	2,732.00	249.10	1,059.00	9.1
1981	3,053.00	288.60	1,215.00	9.5
1982	3,166.00	323.80	1,349.00	10.2
1983	3,406.00	356.10	1,469.00	10.5
1984	3,772.00	387.00	1,581.00	10.3
1985	4,015.00	420.10	1,700.00	10.5
1986	4,232.00	452.30	1,813.00	10.7
1987	4,516.00	492.50	1,955.00	10.9
1988	4,874.00	544.00	2,139.00	11.2
1989	5,201.00	604.10	2,354.00	11.6

Source: HCFA, HHS News (press release), U.S. Department of Health and Human Services, December 20, 1990.

TABLE 4-2

PERCENT DISTRIBUTION OF TOTAL NATIONAL HEALTH EXPENDITURES
BY TYPE OF EXPENDITURE
Calendar Years 1969, 1979, 1989

Type of Expenditure	Calendar Year 1969	Calendar Year 1979	Calendar Year 1989
TOTAL (Billions of Current Dollars)	$ 65.7	$216.6	$604.1
TOTAL (Percent)	100.0%	100.0%	100.0%
Health Services & Supplies	92.5	95.4	96.6
Personal Health Care Expense	86.9	87.1	87.8
Hospital Care	36.7	40.5	38.5
Physicians' Services	18.4	16.6	19.5
Dentists' Services	6.4	5.9	5.2
Other Professional Services	2.0	3.4	4.5
Drugs and Medical Sundries	12.3	8.4	7.4
Eyeglasses and Appliances	2.7	2.1	2.2
Nursing Home Care	6.2	7.9	7.9
Other Health Services	2.2	2.3	2.6
Program Administration and Net Cost of Health Insurance	3.8	5.6	5.8
Government Public Health Activities	1.8	2.7	2.9
Research & Medical Facilities Construction	7.5	4.6	3.4
Research	2.9	2.2	1.8
Construction	4.6	2.4	1.6

Source: HHS News (press release), U.S. Department of Health and Human Services, December 20, 1990. PMA calculations.

TABLE 4-3

DRUGS AND MEDICAL SUNDRIES
AS A PERCENT OF NATIONAL HEALTH EXPENDITURES

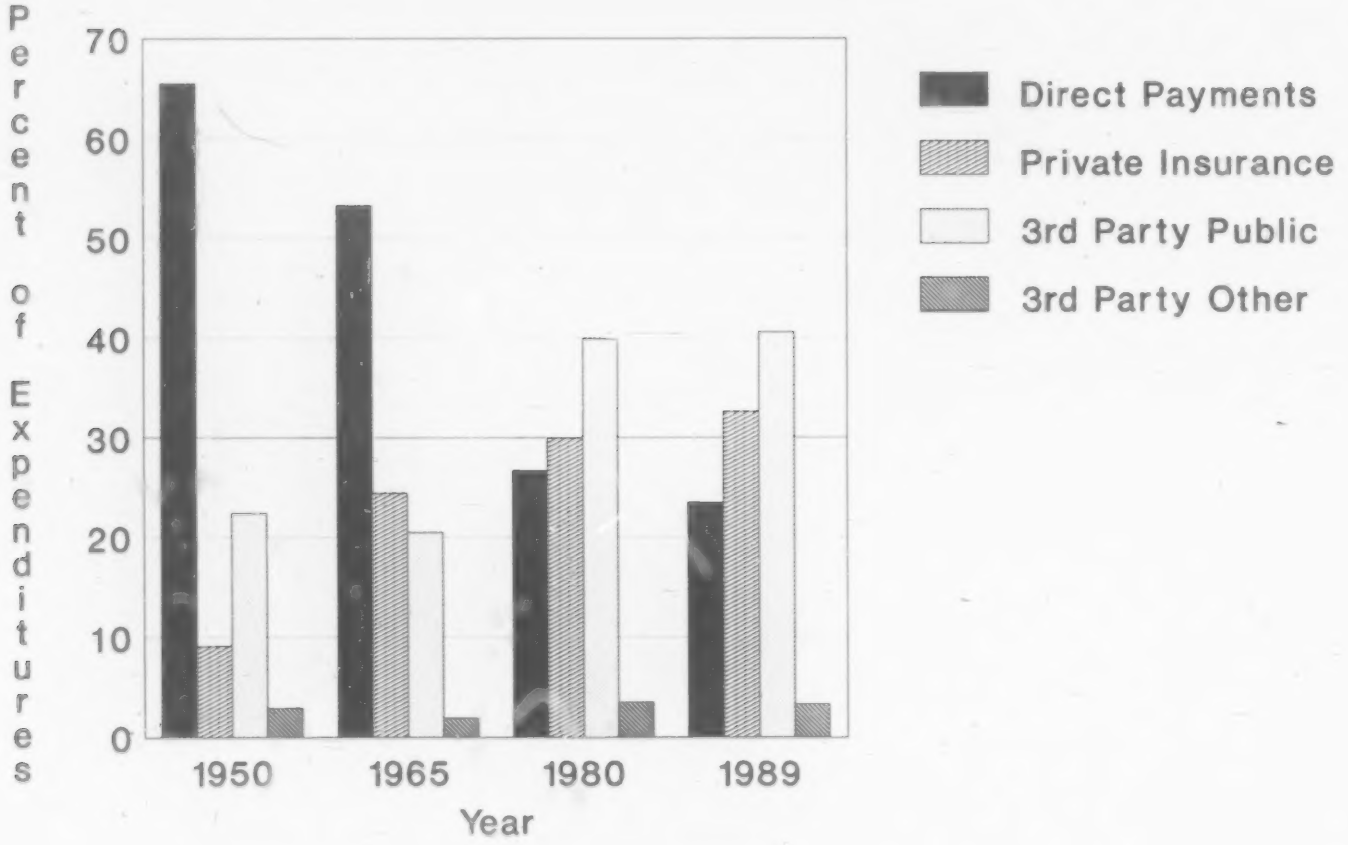
Year	Ratio	Year	Ratio
1960	15.5%	1975	9.8%
1961	15.1	1976	9.3
1962	15.5	1977	8.9
1963	14.8	1978	8.6
1964	14.2	1979	8.4
1965	14.2	1980	8.1
1966	13.7	1981	7.7
1967	13.2	1982	7.6
1968	12.8	1983	7.7
1969	12.3	1984	7.7
1970	11.8	1985	7.6
1971	11.3	1986	7.7
1972	10.8	1987	7.8
1973	10.5	1988	7.6
1974	10.2	1989	7.4

Source: Health Care Financing Administration.

The increase in expenditures due to services per capita and health sector inflation has come largely as a result of health insurance coverage. Private insurance covers 75 percent of the U.S. population; more than 85 percent of the population has private health insurance or is eligible for public programs that provide some financial protection against health care costs.

FIGURE 4-1

Personal Health Care Expenditures
By Source of Funds
Selected Calendar Years



Source:HCFA

Insurance coverage has greatly affected the distribution of health care payments among consumers, private insurers, and the government (Figure 4-1). In 1950, direct out-of-pocket payments by consumers accounted for 65.5 percent of all personal health care expenditures. By the end of 1989, consumers were paying only 23.5 percent of their health care bills, with insurers paying the balance. Over the same period, public financing increased from 22.4 percent of personal health care expenditures in 1950 to 40.6 percent in 1989. Since 1980, however, these percentages have changed only slightly.

HEALTH CARE PROFESSIONS PERSONNEL AND FACILITIES

Health Care Professions Personnel. The number of people employed in the health care industry has grown as a result of increased demand for services and the greater intensity of care provided. Health care employment grew from 4.2 million in 1970 to 8.5 million in 1987, an increase of over 100 percent.

Registered nurses are the largest health care occupational group, with 1.6 million members in 1989. Nursing aides are the second largest group, with 1.4 million members (Table 4-4).

Between 1970 and 1989, the number of active medical and osteopathic physicians grew by 73 percent to 567,000. As a result, there were 19.7 physicians per 10,000 population in 1980, a significant increase from 1950 when there were 14.1 physicians per 10,000 population. By 1989, the total number of physicians was over 560,000 which represents 22.7 physicians per 10,000 population.

TABLE 4-4

U.S. HEALTH INDUSTRY PERSONNEL
SELECTED CATEGORIES
1989

Occupation	Personnel
Doctors of Medicine	542,000 (a)
Doctors of Osteopathy	25,000 (a)
Dentists	175,000 (a)
Pharmacists	165,000 (a)
Health Technologists and Technicians	1,142,000 (b)
Optometrists	21,000 (a)
Registered Nurses	1,559,000 (b)
Practical Nurses	406,000 (c)
Nursing Aides	1,404,000 (b)
Managers, Medicine and Health	154,000 (c)

Sources: (a) Business Mailers, Inc., 1989 data.
(b) 1990 Statistical Abstract of U.S., 1988 data.
(c) 1987 data.

Facilities. In the United States, most medical care is provided in hospitals. In 1873, the U.S. Bureau of Education listed 178 hospitals in the first survey of health care facilities. In 1989, there were 5,455 community hospitals (Table 4-5) with nearly one million beds. These hospitals admitted 31 million patients, provided 286 million outpatient services, employed approximately three million people and spent $185 billion in 1989, an increase in spending of 9.5 percent over 1988. Over 5,000 hospitals have their own pharmacies.

Other types of health care facilities are listed in Table 4-5. The number of nursing homes has increased as a result of an increase in the size of the elderly population, changes in family living arrangements, and public financing of health care for the elderly.

Outpatient and home care will play an increasingly important role in coming years. The number of Medicare certified home health agencies has increased from 1,019 in 1966 to 10,848 in 1989, largely because they began to receive Medicare and Medicaid funding for the services they provide.

TABLE 4-5
SELECTED U.S. HEALTH CARE ESTABLISHMENTS AND SUPPLIERS
1989

Type of Facility		Number
Hospitals (TOTAL)		6,720
Community (Short Term)		5,455
Not-for-Profit (Nongovernment)	3,220	
For-Profit	769	
State and Local Government	1,466	
Noncommunity (e.g., Federal, Long-Term General, and psychiatric)		1,265
Not-for-Profit (Nongovernment)	191	
For-Profit	376	
State and Local Government	316	
Federal Government	340	
Hospital Units of Institutions	42	
Nursing Homes (25 or more beds)[a]		14,567
Skilled Nursing Facility Only (SNF)	3,000	
Combined Skilled Nursing & Intermediate Care Facilities	4,400	
Intermediate Care Facility (ICF)	5,100	
SNFs, ICFs, and Combinations not participating in Medicaid or Medicare	2,100	
Home Health Agencies (Medicare-Certified)		10,848
Pharmacies		65,511

[a] This total is a 1980 figure. The total was distributed by type using 1977 breakdown. Figures do not add to total because of rounding.

Sources: Hospitals: AHA, Hospital Statistics, (1990-1991 edition).
Nursing Homes: NCHS, 1977 National Nursing Home Survey; NCHS, Trends in Nursing and Related Care Homes and Hospitals; PMA estimates.
Home Health Agencies: National Association for Home Care.
Pharmacies: Business Mailers, Inc., 1989 figures.

THE ROLE OF GOVERNMENT IN HEALTH CARE

Since the mid-1960s, government has played a key role in the growth and development of the health care system--largely through direct financing of services and regulation of the health care system. Government programs were created to provide financing for health facilities, products, and services. By greatly increasing the resources available to the health care industry and changing the pattern of demand, these programs have affected both the volume and mix of services provided. In 1965 public expenditures represented 26 percent of the total national health bill of $41.7 billion. By 1989, public funds accounted for 42 percent of total national expenditures of $604 billion.

Public Financing of Health Care: The Medicare and Medicaid Programs.

Two federal programs, Medicare and Medicaid, are primarily responsible for the increases in public health care expenditures. Enacted in 1965 as amendments to the Social Security Act, these programs were designed to enable the elderly and the poor to obtain needed health services.

The Medicare program provides health insurance for persons 65 and older, and for certain people under 65 who are chronically ill or disabled. Part A of the program provides hospital insurance for all eligible beneficiaries. Part B provides insurance for physicians' services and certain other non-hospital services and is available to eligible beneficiaries for a relatively small monthly premium. More than 30.0 million persons are currently enrolled under Medicare, 90 percent of whom are 65 or older. In 1989, payments for Medicare benefits totaled $102.1 billion.

The Medicaid program, run in partnership with participating states, provides payments for medical care for low-income individuals and families. All people who receive cash payments under welfare programs such as Aid to Families with Dependent Children and the Supplemental Security Income program are eligible for Medicaid under federal law. States may extend benefits to other categories of people in addition to the beneficiaries mandated by federal law. Many states provide benefits to the "medically needy" as well as to the federally-mandated groups.

Certain basic services must be offered in any state Medicaid programs, such as inpatient hospital care, outpatient hospital services, laboratory and x-ray services, skilled nursing facility services, family planning services, and physician services. States may also provide additional benefits if they elect to do so, including prescription drugs, eyeglasses, and inpatient psychiatric care.

The Medicaid program is state-administered and costs are shared by participating states and the federal government. In 1989, Medicaid paid $62.4 billion in medical benefits for acute health care and long term care for roughly 22 million recipients, a 13.8 percent increase over 1988. Hospital services, usually the largest category of expense, accounted for 37.0 percent of total Medicaid expenditures. Expenditures for nursing home care were 33% and physicians' services represented 6.8 percent. Retail pharmacy sales of prescription drugs and medical sundries accounted for 6.6 percent of 1989 health care expenditures under Medicaid, or about $4.1 billion (Figure 4-2).

In addition to Medicare and Medicaid, the federal government provides health care benefits for specific beneficiary groups such as military personnel and their dependents, veterans, and Native Americans. In fiscal years 1982 and 1983, block grants were introduced to consolidate federal spending in areas such as disease prevention and maternal and child health.

Cost Containment and Regulation.

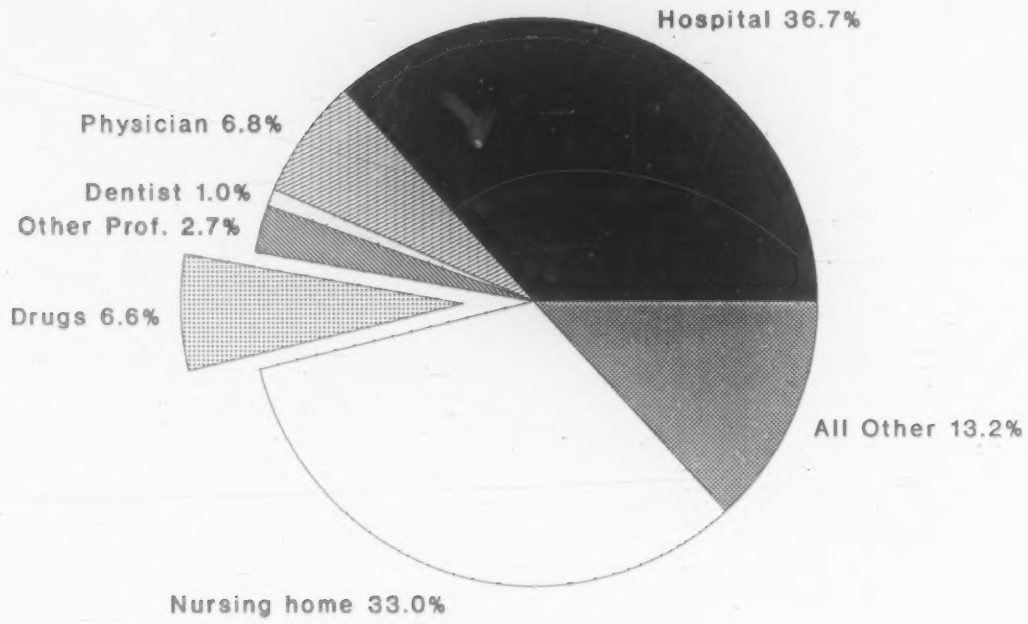
During the decade ending in 1989, national health expenditures grew at an annual rate of 10.4 percent, increasing from $249.0 billion in 1980 to $604.1 billion in 1989. During the same period, the consumer price index increased by 4.3 percent annually and the gross national product by 7.4 percent.

In response to this increase in health care expenditures, government at all levels initiated measures to keep costs within acceptable limits. Government efforts to restrain costs have focused on the controllable elements in this list: medical care price inflation in excess of general inflation, and increases in utilization of services and intensity of care.

Since 1972, federal and state governments have taken many steps to become "prudent buyers" of health care services, and have imposed regulatory limits on the health care system. In 1972, Congress established the Professional Standards Review Organization (PSRO) program, mandating review of Medicare hospital admissions to assure quality of care and reduce utilization. In 1974, the National Health Planning and Resources Development Act revised and strengthened state and local health planning. The planning agencies sought to restrain expenditure growth by limiting the construction of excess capacity while ensuring that adequate services were available. The available evidence indicates that they were unable to forestall excess capacity.

FIGURE 4-2

Medicaid Expenditures For Health Services & Supplies Percentages by Type of Service



Year 1989

Source:HCFA

Numerous other actions were taken to restrain expenditure growth including state regulation of hospital rates, limitation of hospital Medicare and Medicaid reimbursement, and restriction of payment to other providers. In the case of drugs, the Department of Health and Human Services promulgated Maximum Allowable Cost (MAC) regulations limiting reimbursement for numerous multisource source products which are widely and consistently available. States have initiated or considered other programs to reduce Medicaid drug expenditures. These include capitation payment of pharmacies, restriction of drug choice to products on a state-established formulary, drug utilization review, and volume purchasing plans. The Health Care Financing Administration published additional regulations in 1987 for Medicaid drug reimbursement. The reimbursement limits established under these regulations apply to a state's aggregate expenditures rather than to specific drugs. Specific upper limits may be established for multiple-source drugs meeting certain criteria.

The Congress passed the new Medicaid Drug Rebate Legislation in 1990 in a further attempt to reduce Medicaid expenditures for drugs. Under the law, manufacturers must provide rebates to the states for drugs covered under Medicaid. There is a separate methodology for determining the rebates on single source and innovator multiple source drugs and on noninnovator multiple source drugs. States may exclude certain classes of drugs determined by the Secretary of Health and Human Services to be subject to clinical abuse or inappropriate use.

APPENDIX

KEY SOURCES OF DATA

KEY SOURCES OF DATA

1. Current Industrial Reports, Pharmaceutical Preparations, Except Biologicals, 1989, Bureau of the Census, U.S. Department of Commerce. (I-2)

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22. A. D. Little, Inc., Use of Beta Blockers in the Treatment of Angina: A Cost-Benefit Study, Pharmaceutical Manufacturers Association, 1984. (III-2)

23. Weisbrod and Huston, Benefits and Costs of Human Vaccines in Developed Countries: An Evaluative Survey, Pharmaceutical Manufacturers Association, 1984. (III-3)

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1991 Edition

Facts at a Glance

Pharmaceutical Manufacturers Association

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I. An Overview of the Pharmaceutical Industry in the U.S.

The research-based pharmaceutical industry is one of America's most important high-technology industries. The creative contributions of the industry add immeasurably to the quality of life of people worldwide.

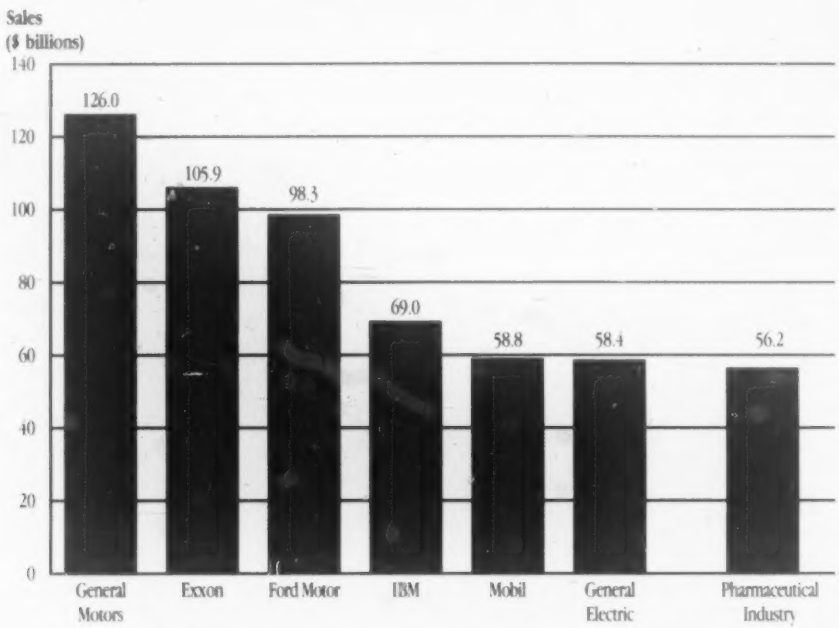
This relatively small, competitive industry also makes major contributions as an industrial entity:

- It is a steady employer of more than 300,000 skilled and productive individuals who are located in facilities throughout this country and the world.
- It leads the world in total sales of pharmaceuticals.
- More than one-third of total sales were sales to other countries.

A Relatively Small Industry

Compared to other major U.S. industries, the pharmaceutical industry is relatively small. In 1990, total worldwide sales of PMA member firms were $56.2 billion, making the entire industry smaller than any of the first six companies on the Fortune 500 list.

Sales of the Fortune Top Six Companies Compared to Sales of the Pharmaceutical Industry, 1990

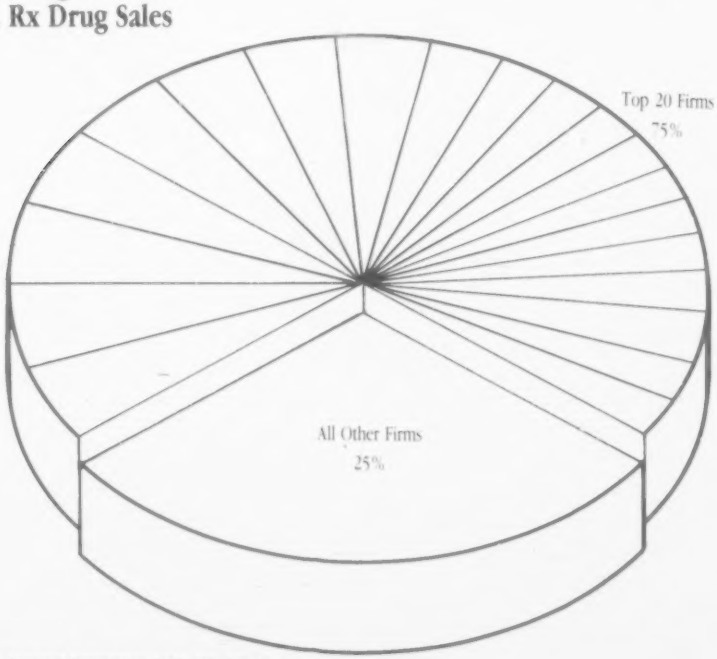


Source: Fortune Magazine, April 22, 1991, p. 286

The Industry is Highly Competitive

The pharmaceutical industry is highly competitive. The share of total sales held by the twenty largest firms accounts for 75 percent of industry sales; all other firms account for 25 percent of the market. None of the major companies holds more than a 7.6 percent share of the market.

Percentage of Total U.S. Rx Drug Sales

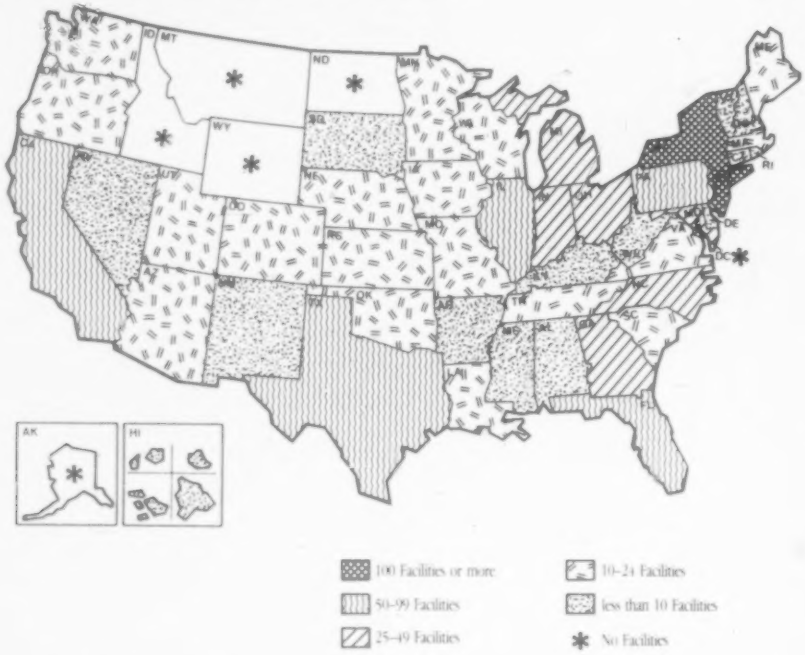


Source: National Prescription Audit, IMS America

Industry Facilities Throughout the United States

In the United States, drug industry facilities are located in all states except Alaska, Montana, Idaho, Wyoming and North Dakota, with the concentration in New Jersey, New York, Pennsylvania, Indiana, Illinois, Michigan, Ohio, California, Texas, Florida, Georgia, North Carolina and Maryland.

Location of Industry Facilities in the U.S.

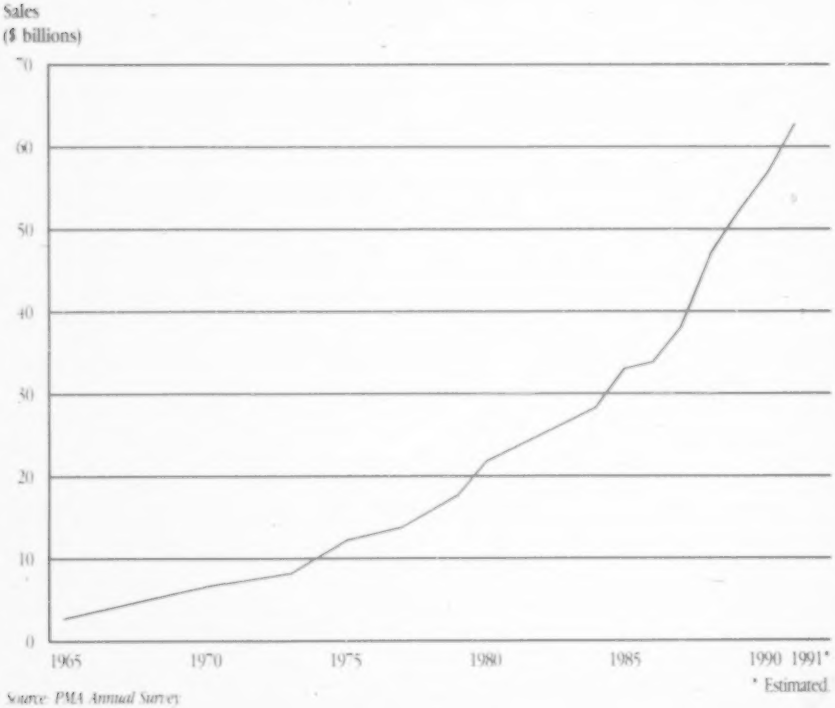


Source: U.S. Department of Commerce, Bureau of Census

The Industry's Contribution as a Producer . . .

Total worldwide annual sales of PMA members grew from $4.1 billion in 1965 to an estimated $63.0 billion in 1991. While domestic annual sales increased 1,213 percent to an estimated $40.7 billion, foreign sales grew 1,927 percent for the same period to an estimated $22.3 billion. In 1991, foreign sales will represent 35 percent of total worldwide sales, compared to one-quarter in 1965.

Worldwide Sales 1965–1991

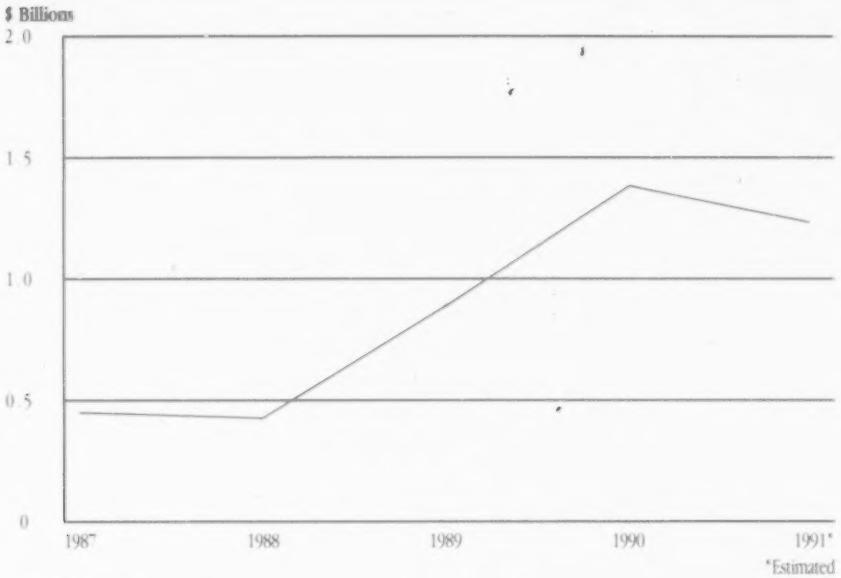


Source: PMA Annual Survey

The Industry's Contribution as a Trading Partner. . .

In a time of national concern about U.S. competitiveness and trade, the U.S. pharmaceutical industry is sustaining a favorable balance of trade. In 1991, the trade surplus from pharmaceuticals is estimated to reach $1.23 billion.

Pharmaceutical Trade Balance, 1987–1991



Source: U.S. Commerce Department

II. The Industry's Commitment to Research and Development

The essential characteristic of the research-based pharmaceutical industry is its continued commitment to discovering, developing and marketing new medicines. This mission requires an increasing financial commitment to R&D—from $600 million in 1970 to $9.2 billion in 1991.

Innovation in new drug therapy has become significantly more complex, time-consuming and costly over the years. For example:

- It takes an average of 12 years from the time a drug is discovered until it is available to the patient.
- In 1990, the average FDA review time was 27.7 months.
- It cost $231 million to discover and develop a new drug product.
- Approximately 17 percent of U.S. pharmaceutical sales and export revenues will be reinvested in research in 1991.

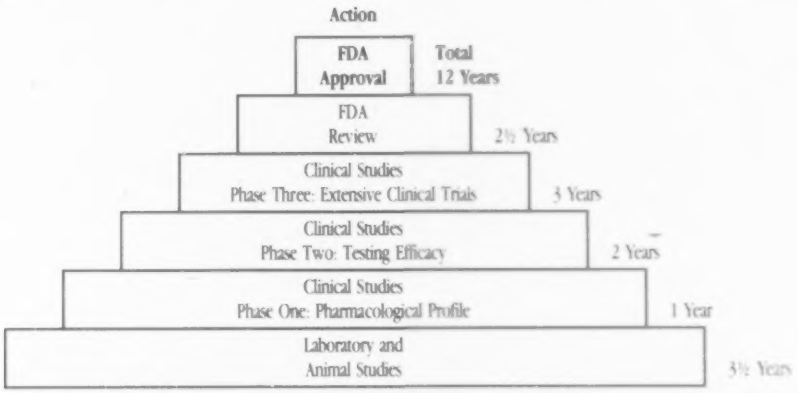
Over 90 percent of the most prescribed drugs in the U.S. were discovered by the research-based pharmaceutical industry.

In the last four decades, the industry has produced a wide range of therapeutic products. It has now turned to biotechnology and other new technologies to continue to pursue new avenues for drug innovation.

Twelve Years From Discovery to Marketing

It takes approximately 12 years from the time that the new drug is discovered until it is available to the patient in a pharmacy or hospital.

The Steps Toward Drug Approval



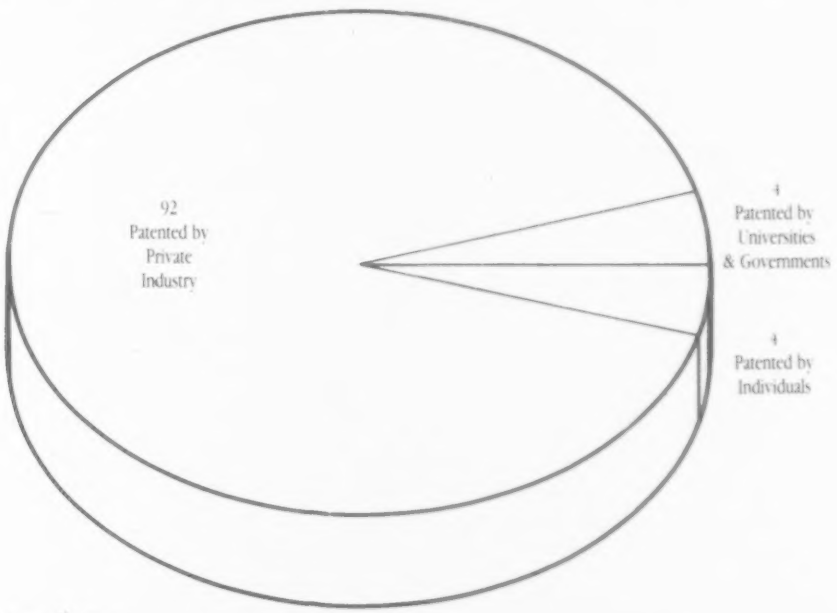
Source: Joseph DiMasi, Tufts University

Industry R&D is the Source of Nearly All New Drugs

The odds are high that the next treatment for AIDS, or cancer, or Alzheimer's disease will come from the laboratories of pharmaceutical research companies.

Sources of 100 Patented Drugs

Of the 100 Most Prescribed Patented Drugs in the United States . . .

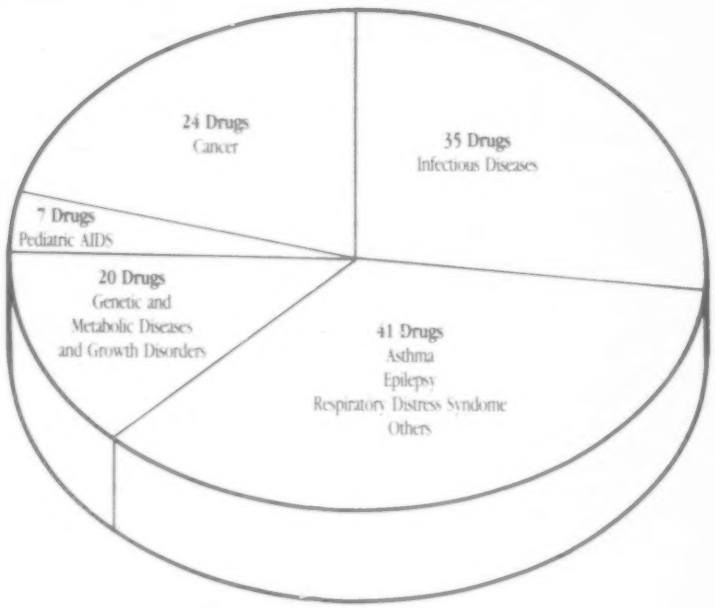


Source: PMA Survey

Drugs Being Developed for Children

Despite the difficulties of testing drugs in children, there are 114 pediatric drugs and vaccines in clinical trials, involving 127 research projects and 56 companies. A quarter of the projects—32—are for rare disorders such as chronic granulomatous disease.

Drugs in Development for Children

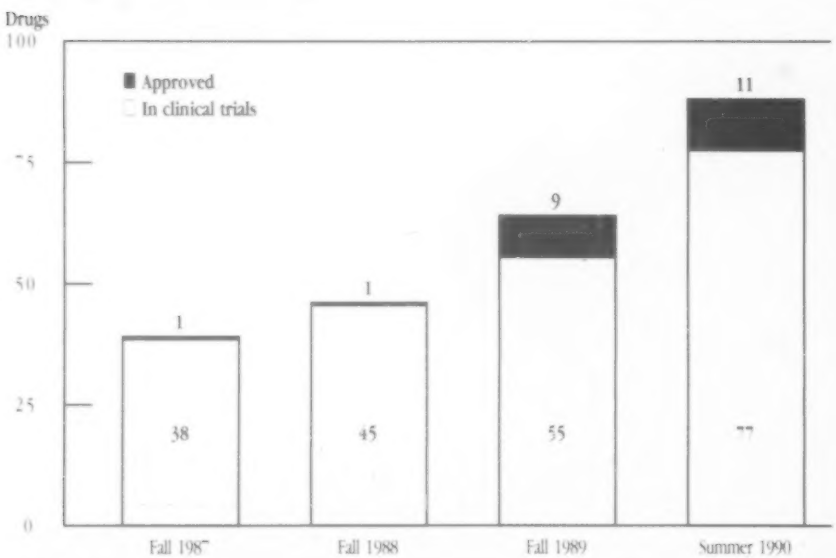


Source: PMA New Medicines in Development for Children Survey

Drugs Being Developed for AIDS-Related Diseases

Since the HIV virus was first identified in 1983, 11 AIDS-related therapeutics have come on the market and another 77 are being tested in clinical trials. Products in development include 21 antivirals, 19 anti-infectives, 15 cytokines, 10 immunomodulators and three vaccines, as well as other drugs to treat AIDS and its related diseases, such as opportunistic infections.

AIDS Medicines in Development

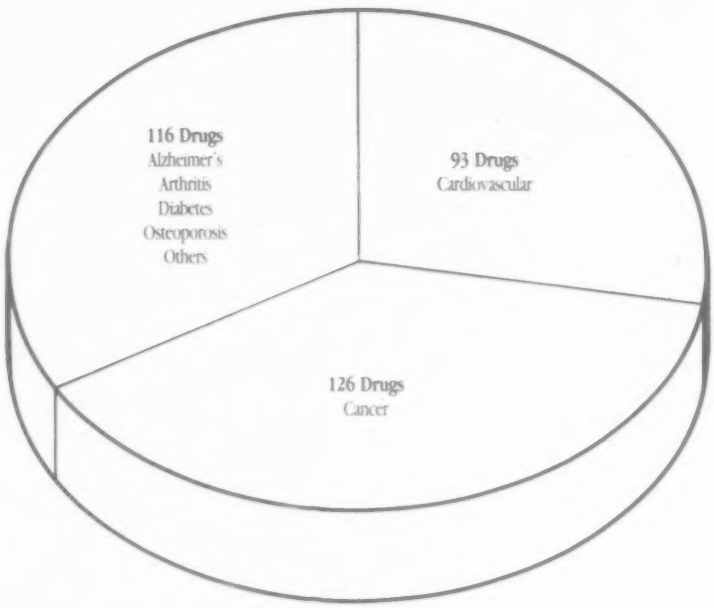


Source: PMA AIDS Medicines in Development Survey

Drugs Being Developed for Older Americans

This year PMA companies are testing 329 new medicines for 45 diseases that commonly afflict older Americans. Some drugs are being tested for more than one condition.

Drugs in Development for Older Americans

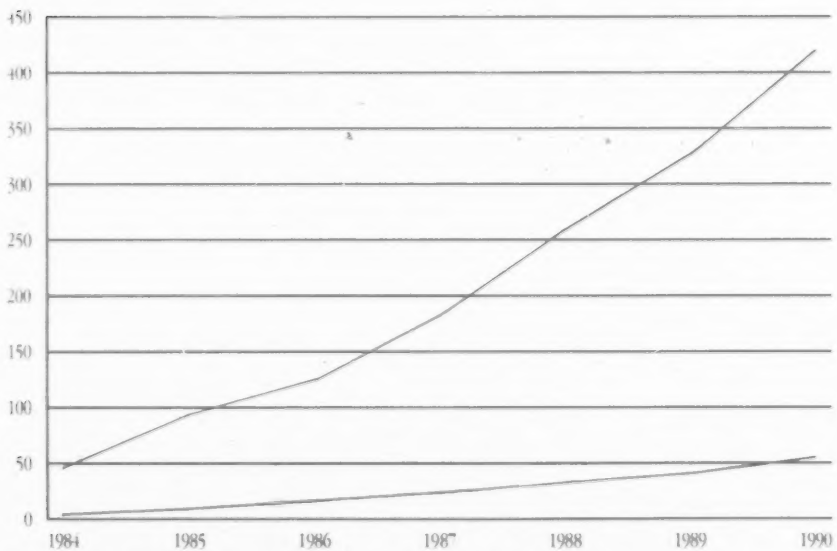


Source: PMA Survey

Results of the 1983 Orphan Drug Act

One of every 7 drugs approved since 1984 has been an orphan drug. Since the law was passed, 54 drugs to treat 60 rare disease conditions have been approved and the Food and Drug Administration has granted 422 orphan designations. Currently, 176 orphan drugs are in human clinical trials or pending review at FDA.

Cumulative Growth of "Orphan" Drugs

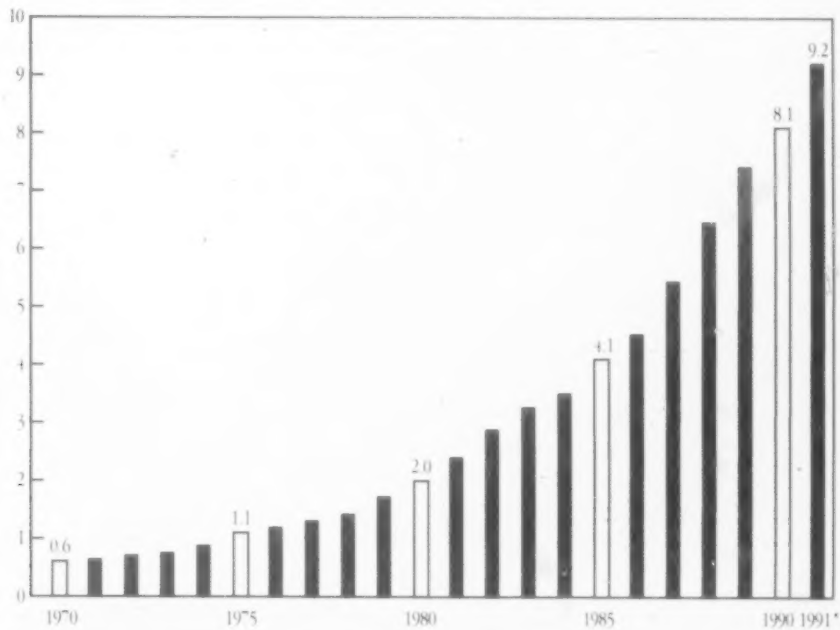


Source: Office of Orphan Products Development, FDA; PMA Orphan Products in Development *Survey*

Major Research Commitment—R&D Expenditures

In 1991, the research-based pharmaceutical companies will invest a record $9.2 billion in research and development, an increase of 13.6 percent from 1990. This reseach commitment has been growing at a rate of more than 10 percent a year. The industry's research investment has doubled every five years since 1970.

R&D Expenditures for PMA Member Firms

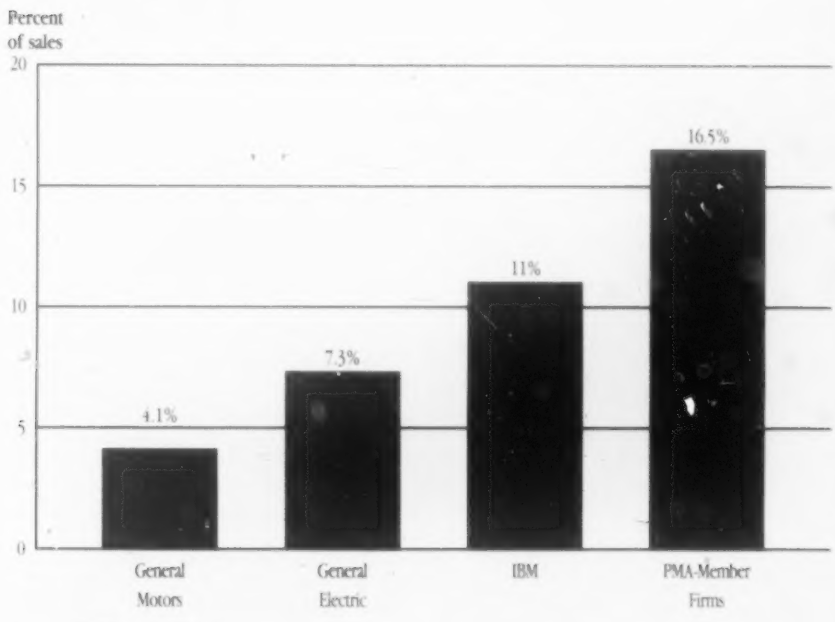


Source: PMA Annual Survey

Research Spending—A High Percentage of Sales

Compared with other major U.S. industries, the pharmaceutical industry devotes a higher percentage of its sales and export revenues to research and development—16.5 percent in 1990 for all PMA-member companies. The percentage has increased from 11.7 percent in 1980.

R&D Expenditures as a Percentage of Sales, 1990

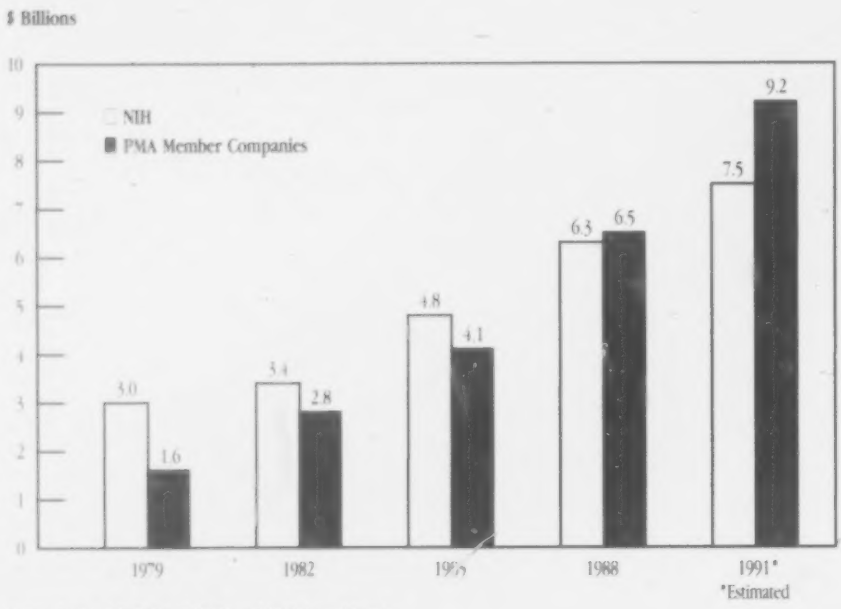


Source: Company Financial Data

A Leading Source of Medical Research

Private industry's investment in medical research and development now outstrips the amount committed by the National Institutes of Health. The research-based pharmaceutical industry's investment of $9.2 billion in 1991 surpasses the $7.5 billion appropriations for NIH health research.

R&D Expenditures by NIH and PMA Members 1979–1991

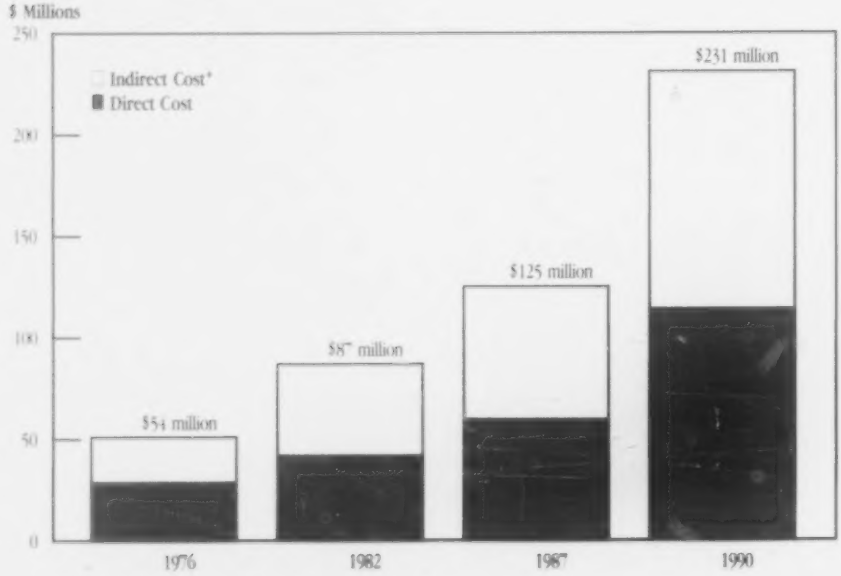


Source: National Institutes of Health and PMA Annual Survey

The High Cost of Drug Development

On average, it costs $231 million to bring a new drug through discovery, clinical testing, development and FDA approval to begin marketing. This cost has increased sharply in recent years. Major contributors to the increased cost include the intricate nature of modern research and the expense of the highly sophisticated laboratory equipment it requires. In addition, as the focus of research has shifted toward chronic and degenerative diseases, complicated and extensive clinical testing is often necessary to prove efficacy of new medicines.

Cost of Developing a New Drug



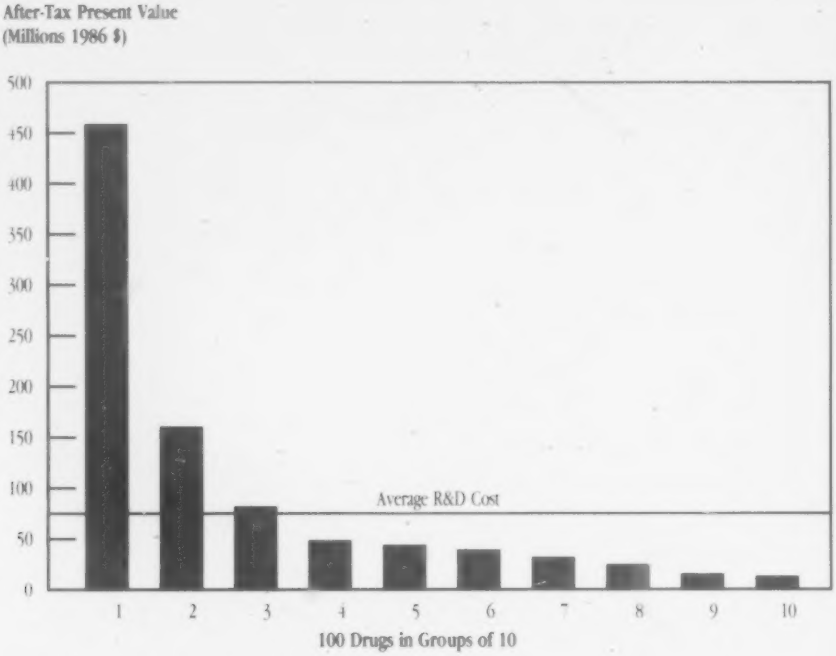
*Cost of money invested over time ("Opportunity costs")

Source: 1976: Ronald Hansen, University of Rochester
1982: Ronald Hansen, University of Rochester, adjusted by PMA for inflation
1987: Stephen N. Wiggins, Texas A&M University
1990: Joseph DiMasi, Tufts University

The Difficulty of Recovering R&D Costs

Duke University economist Henry Grabowski discovered in a recent study that only 3 out of every 10 drugs introduced between 1970 and 1979 subsequently recovered their R&D costs. Grabowski concluded that "real drug price increases in the 1980s were necessary for the average new drug introduction to recover its R&D costs."

Earnings Performance of 100 Drugs vs. R&D Cost

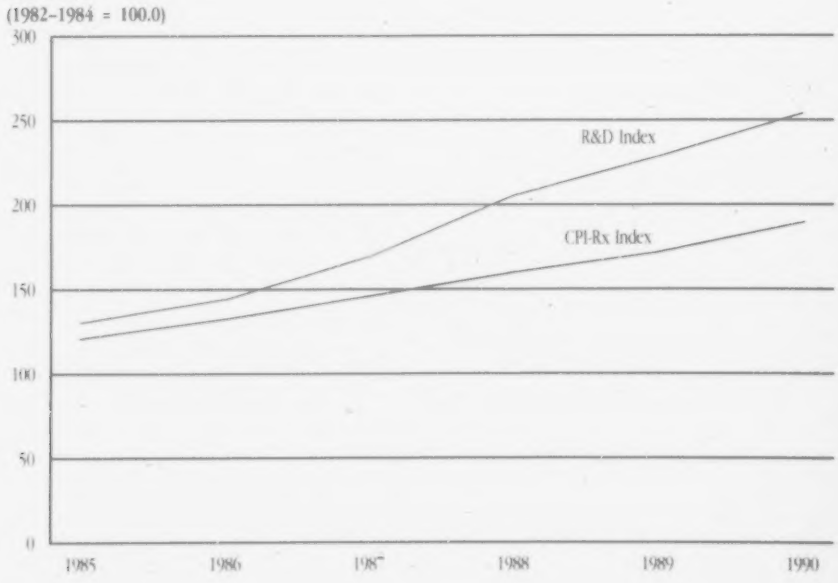


Source: H. Grabowski, Ph.D., and J. Vernon, Ph.D., Management Science, July 1990.

Drug Price Increases Have Not Kept Pace With R&D Spending Increases

In 1990, inflation in pharmaceutical research was virtually double drug price increases across the industry.

Increases in R&D Spending vs. Increases in Drug Prices



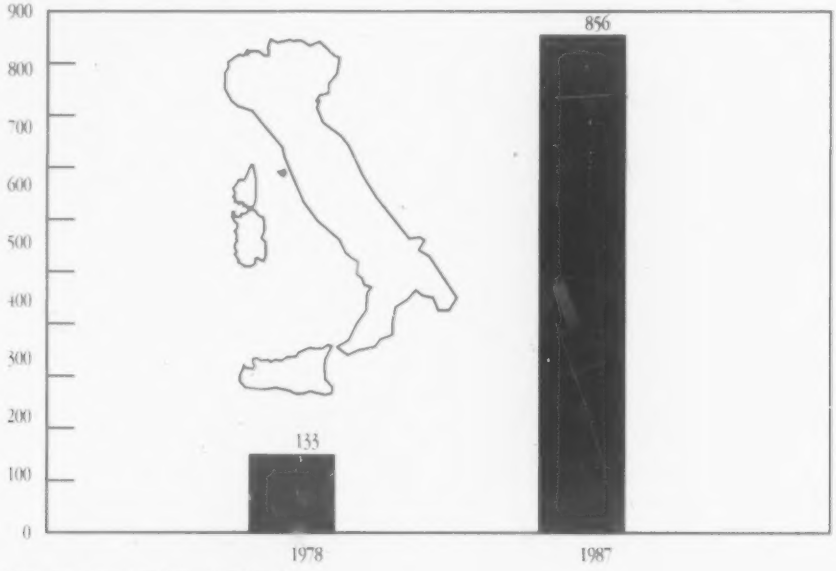
Source: Bureau of Labor Statistics and PMA Annual Survey.

Patent Protection is Directly Related to R&D Expenditures

In 1978, Italy greatly strengthened what was very weak or inadequate patent protection for pharmaceuticals. The year the law was changed, 133 billion lira were invested in R&D. In 1987, there was a fivefold increase, to 856 billion lira. PMA has advocated strong patent protection as an essential ingredient of pharmaceutical R&D.

Italian Pharmaceutical R&D Investments

Billions of 1985 Italian Lira



Note: Patent Protection Strengthened in 1978

Source: G. Jodi, Patents and Trademarks News, *October 1988*

III. The Drug Approval Process in the U.S. and Abroad

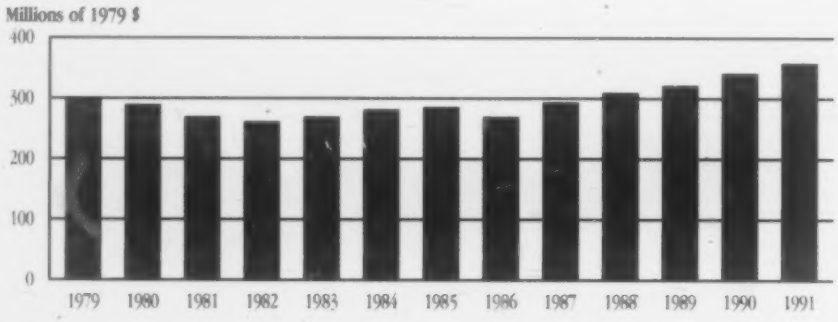
As a result of increasing numbers of new medicines in development and lack of resources at the Food and Drug Administration, the FDA is still taking too long to approve drugs for the U.S. market, allowing important medicines to appear first in other countries.

FDA's Budget, Workforce Are Not Keeping Pace With the Challenge

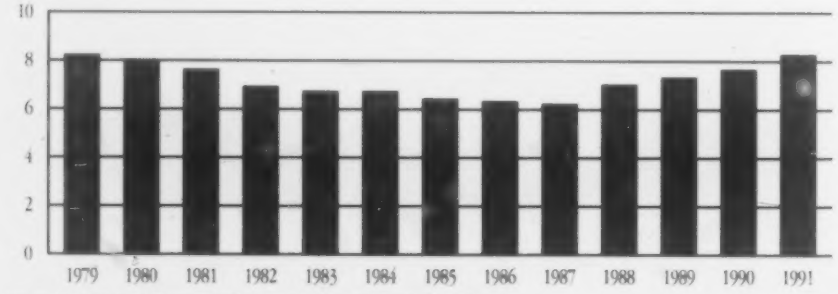
For most of the '80s, FDA's budget did not even keep pace with inflation, while the number of its full-time employees has only now caught up with 1979 levels.

The FDA's Resources

Budget



Employees

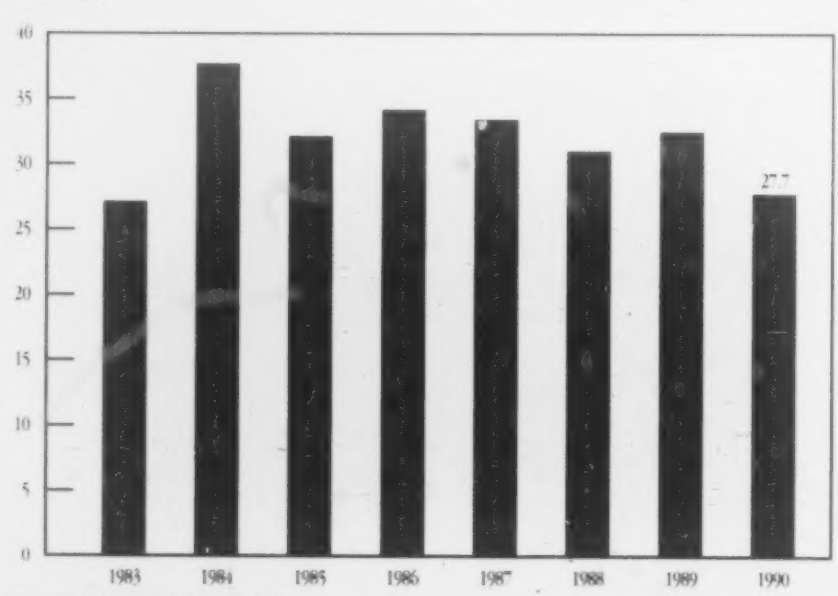


Source: The New York Times, *December 4, 1989; Food and Drug Administration*

A Long Review Process

The average FDA review time for the 23 new molecular entities approved in 1990 was 27.7 months. Shown at right are mean review times since 1983 for all NMEs.

Mean Approval Times 1983–1990

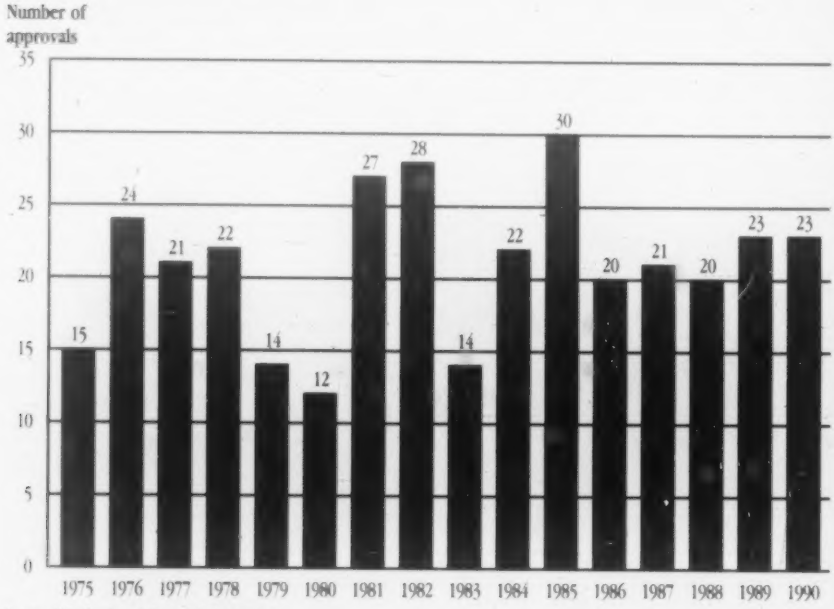


Source: U.S. Food and Drug Administration

FDA New Drug Approvals

The FDA approved 23 new drugs (new molecular entities or NMEs) in 1990, the same number approved in 1989.

U.S. NME Approvals per Year

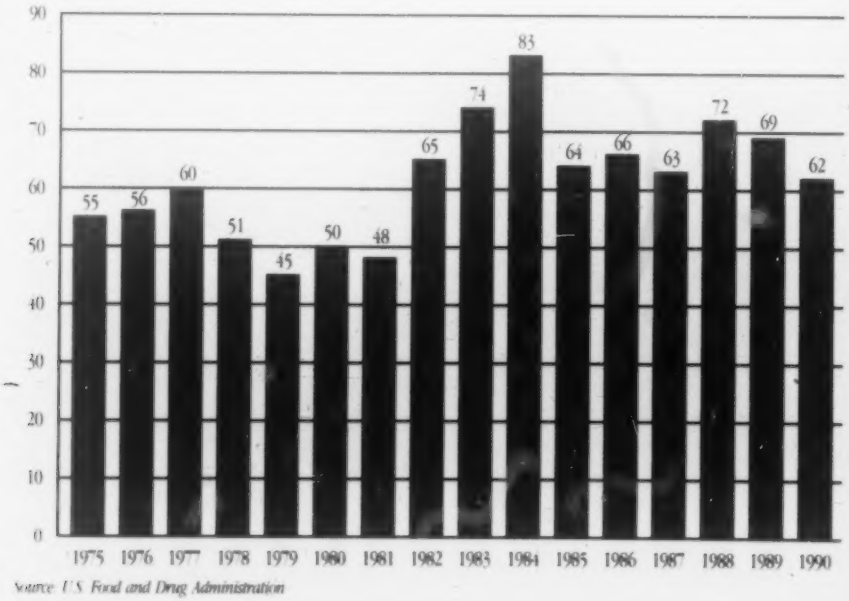


Source: U.S. Food and Drug Administration

FDA Backlog Remains Large

FDA's workload and backlog for new drug applications have varied over the years.

NME Backlog

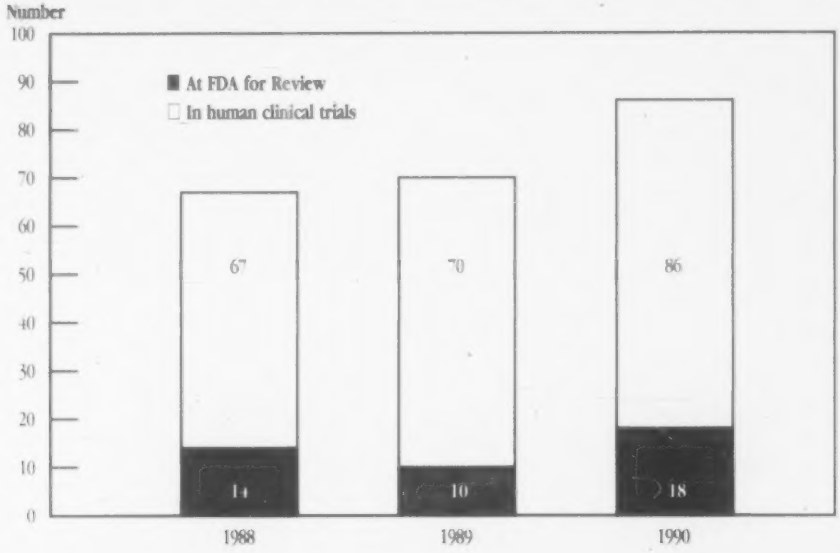


Source: U.S. Food and Drug Administration

The Growing Number of Biotechnology Medicines in Development

Only 14 biotechnology medicines have been approved by the Food and Drug Administration. Meanwhile, there are mounting numbers of genetically engineered drugs and vaccines in clinical trials and at the FDA for review.

Biotechnology Medicines in Clinical Development

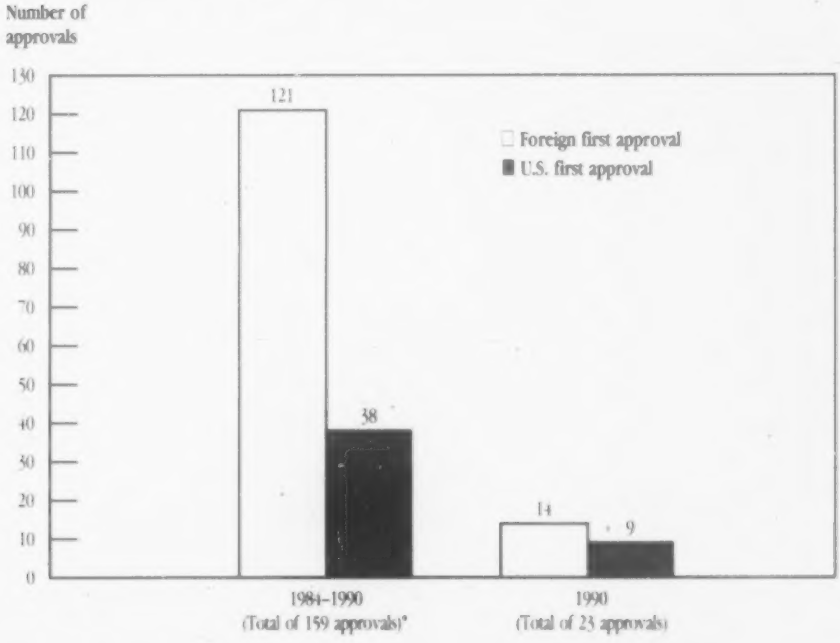


Source: U.S. Food and Drug Administration

New Drugs Often Approved Overseas First

Of the 158 new molecular entities approved by the Food and Drug Administration between 1984 and 1990, 121 were first approved in a foreign country, a trend that has become common in recent years. It should be noted that companies often seek approval for their products first in foreign countries.

NMEs Marketed Abroad Prior to U.S. Approval (1984–1990)



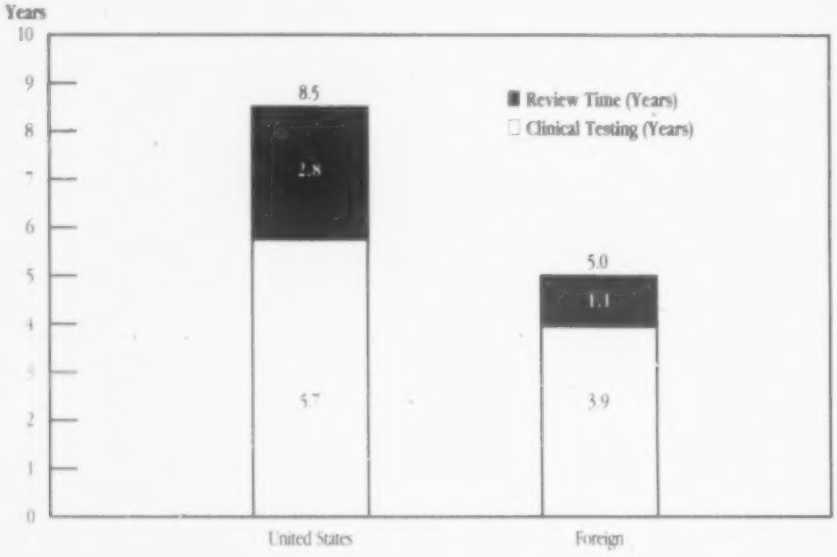
*One NME approved in 1987 has not yet been marketed anywhere, although it was first approved abroad.

Source: PMA Survey

The Long Road to Market for U.S. vs. Foreign Drugs

A survey of 45 new molecular entities approved by FDA between 1986 and 1990 found, on average, that the same products were developed abroad and approved by foreign review agencies 3.5 years faster than they were in the U.S.

Average Development Times for 45 NMEs

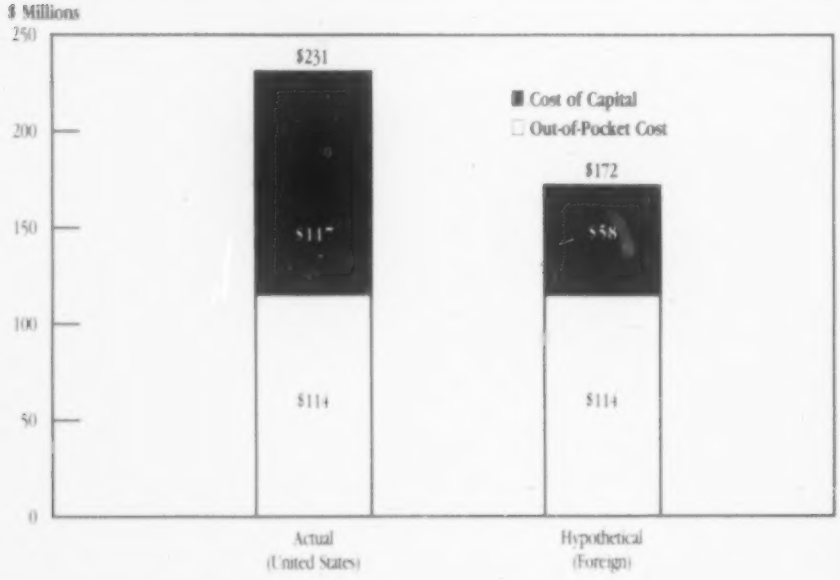


Source: PMA Survey of New Molecular Entities Approved by FDA 1986–1990

The Cost of Delays in Approving New Drugs

The $231 million average cost of getting a new drug onto the U.S. market could be cut by $59 million if clinical testing and FDA review times were reduced from the current 8.5 years to the 5 years that is the rule overseas.

Drug Development Cost U.S. and Foreign Development Times



Source: J.A. DiMasi, Ph.D., Tufts University; PMA Calculation

New Drugs Approved in 1990

The 23 drugs approved by the FDA in 1990 include the following (drugs approved first in the U.S. are underlined).

New Drugs Approved in 1990

Name	Company	Name	Company
Adagen	Enzon	Floxin	McNeil
Arduan	Organon	Geref	Serono Laboratories
Cardiolite	DuPont Merck	Hexalen	U.S. Bioscience
Cardiotec	Bristol-Myers Squibb	Idamycin	Adria
Cardura	Pfizer	Ornidyl	Marion Merrell Dow
Cutivate	Glaxo	ProSom	Abbott
Diflucan	Pfizer	Rev-Eyes	Angelini Pharmaceuticals
Dipentum	Pharmacia	Synarel	Syntex
DynaCirc	Sandoz	TechneScan MAG3	Mallinckrodt
Ergamisol	Janssen	Ultravate	Bristol-Myers Squibb
Ethmozine	DuPont Merck	Vascor	McNeil
Exosurf	Burroughs Wellcome		

Source: U.S. Food and Drug Administration

IV. The Value of Pharmaceuticals in Improving Health Care and in Reducing the Costs of Illness

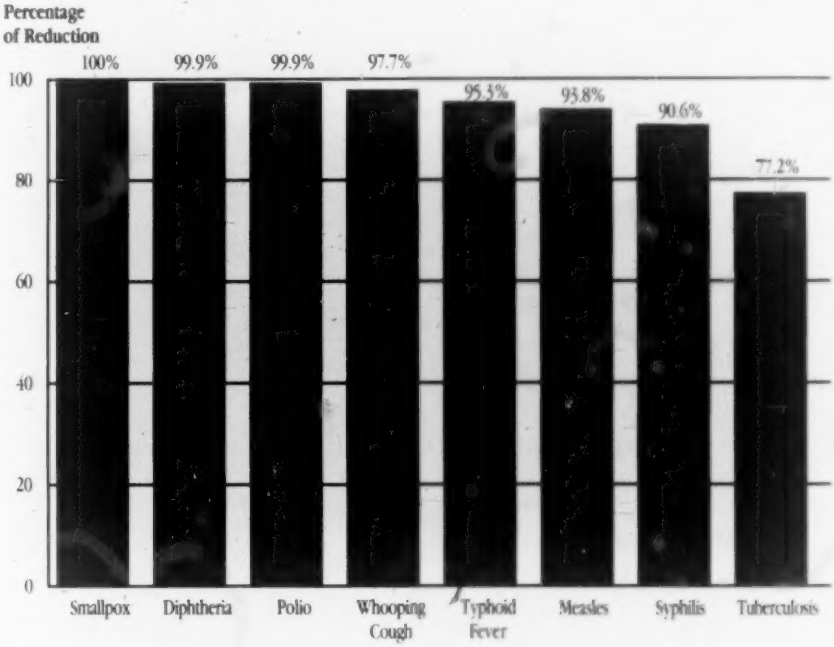
Among the most important technological advances of the twentieth century are those that have strengthened our ability to conquer disease and have extended the length and enhanced the quality of human life.

Medicines discovered and developed by the research-based pharmaceutical industry have yielded dividends in both lives and dollars saved.

Improved Health: Reduced Morbidity

Medicines have contributed significantly to the reduction of disease. Medicines have virtually eliminated diphtheria and polio.

Reduction in Reported U.S. Cases of Selected Diseases 1940–1989

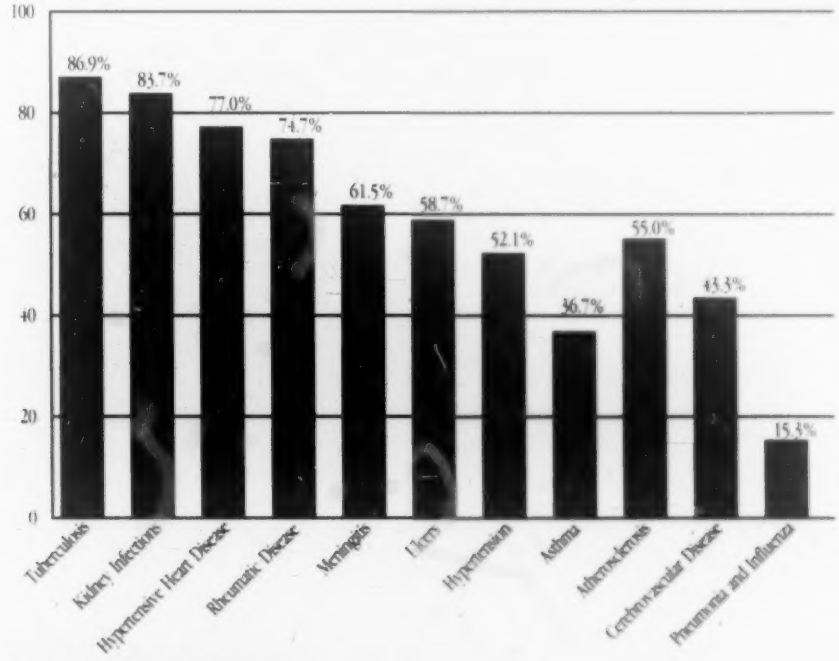


Source: Morbidity and Mortality Weekly Report, Annual Summary, 1989, U.S. Department of Health and Human Services

Improved Health: Reduced Mortality

Pharmaceuticals have helped reduce deaths from diseases such as tuberculosis, kidney infection and hypertensive heart disease.

Mortality: Reduction in U.S. Deaths per 100,000 Population From Selected Diseases 1960–1988

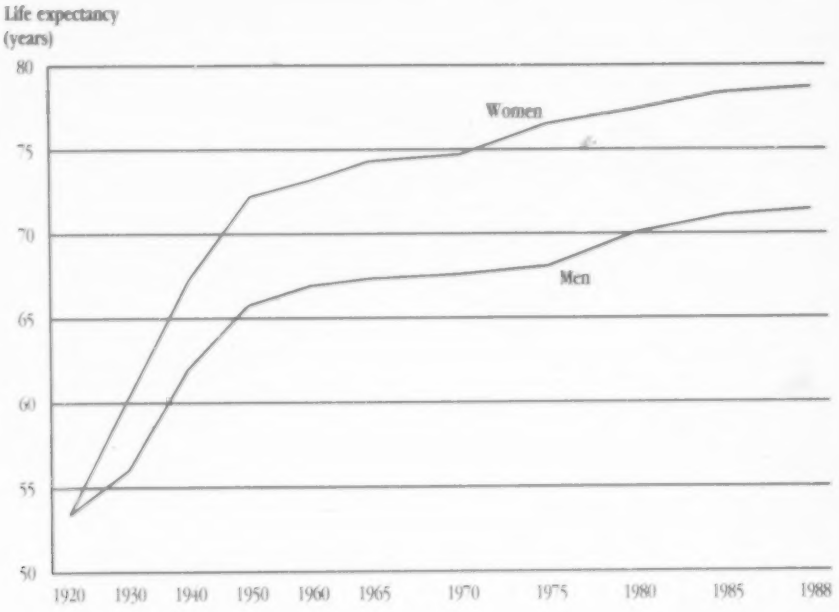


Source: National Center for Health Statistics

Improved Health: Increased Life Expectancy

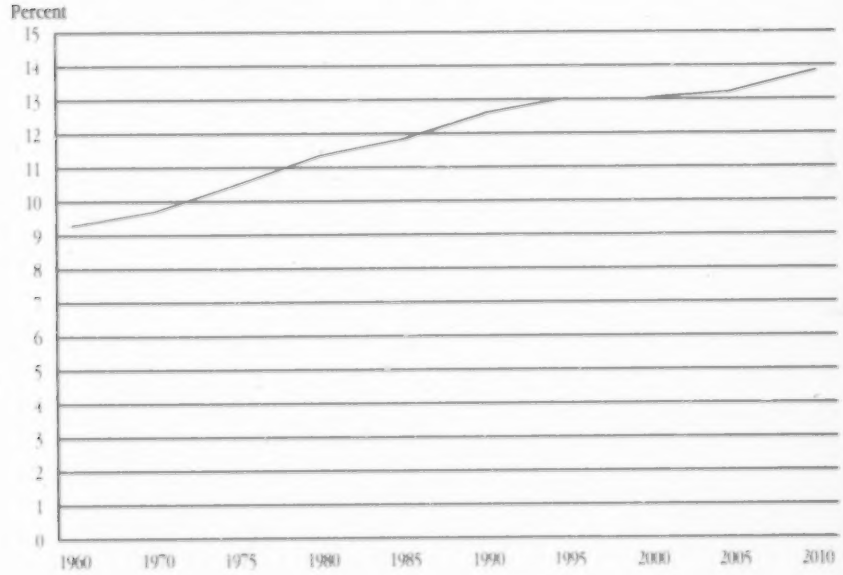
New medicines have helped increase life expectancy. The average life expectancy for a person born in 1920 was 54.1 years, compared to 74.9 years today. The percent of people 65 years and older is increasing dramatically and will continue to do so through the end of the century.

U.S. Expectation of Life at Birth 1920–1988



Source: Statistical Abstract (1989), U.S. Department of Commerce

Over-65 Population as a Percent of U.S. Population 1960–2010

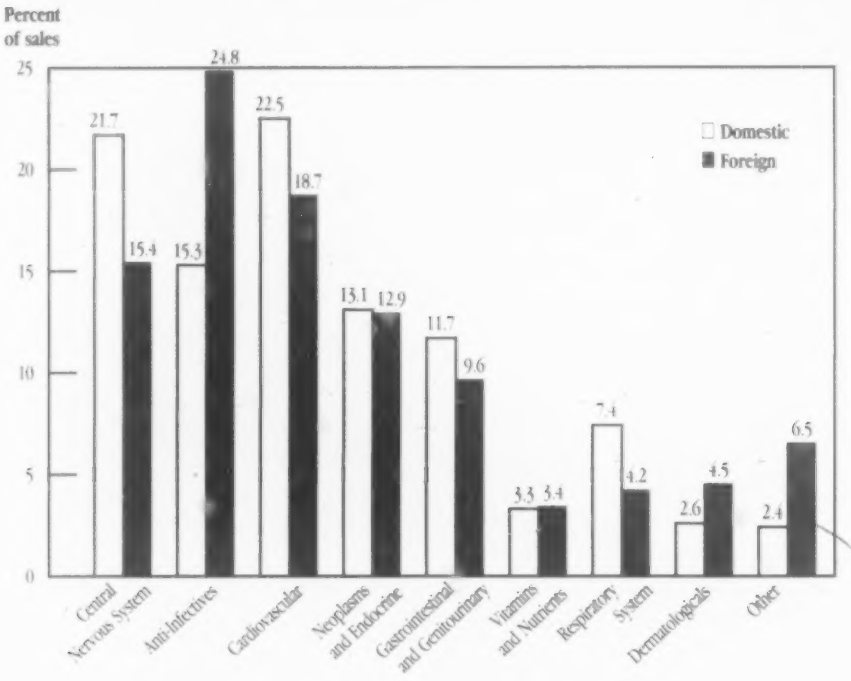


Source: U.S. Department of Commerce, Bureau of Census

A Wide Range of Therapies

The pharmaceutical industry produces drugs in many therapeutic categories. In the U.S., cardiovascular products are the leading category. Abroad, anti-infectives are the leading sellers.

PMA Member Firms' Domestic and Foreign Sales of Ethical Drugs for Human Use in 1988



Source: PMA Annual Survey

V. Today's Health Care Environment

The changing health care environment greatly affects the research-based pharmaceutical industry.

Today's health care system has to deal with a different population—an older one—due in part to advances made by the pharmaceutical industry.

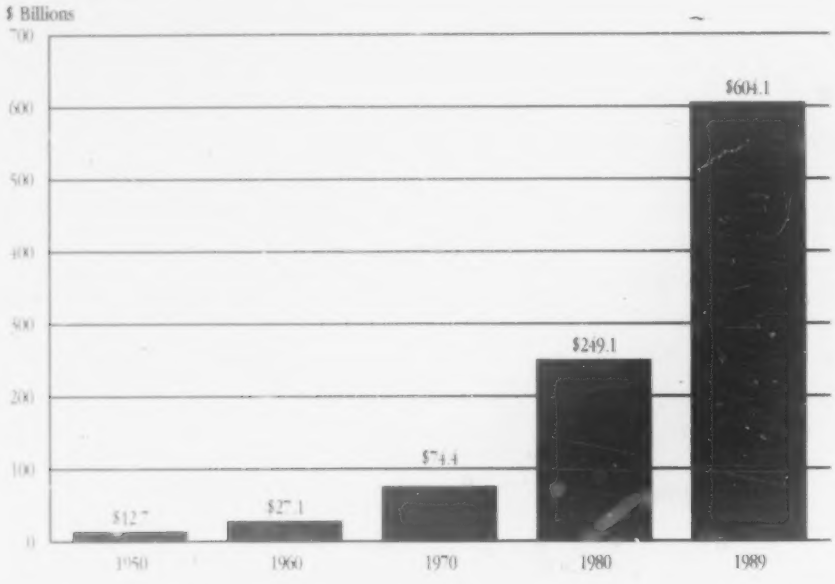
As a result of the growing population, inflation, and spiraling costs, national health expenditures continue to rise. So do per capita health care expenditures and health expenditures as a percentage of the GNP. By contrast, drugs as a percent of national health expenditures have steadily declined.

As cost containment strategies are initiated, it is important to remember that drugs represent a small percentage of national and Medicaid expenditures and can help to reduce the total costs of health care.

National Health Expenditures on the Rise

National health expenditures have been doubling or tripling every decade.

National Health Expenditures (Current Dollars)

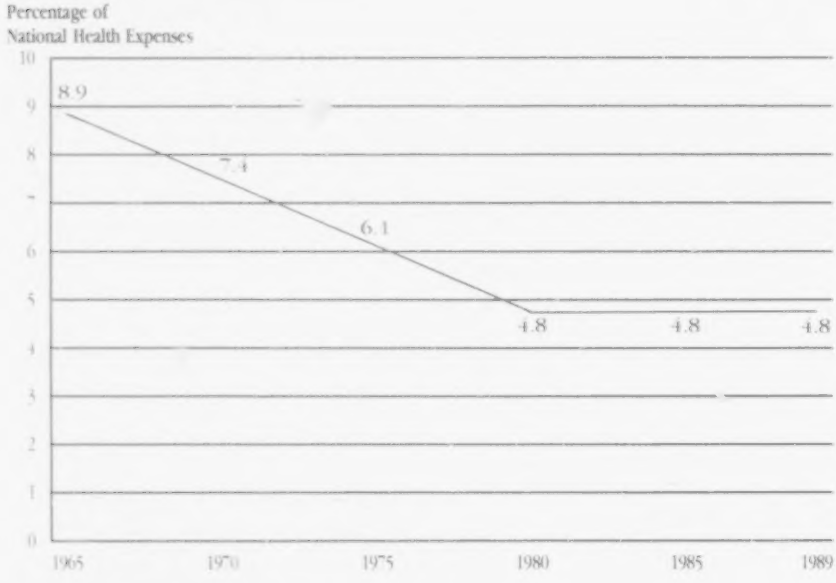


Source: Health Care Financing Administration

Drugs as Percent of National Health Expenditures on the Decline

Of every dollar spent on health care, less than five cents is spent on outpatient prescription drugs. That figure has declined—down from 8.9 cents in 1965—despite the fact that drugs have displaced other more expensive forms of therapy.

Drugs as a Percentage of National Health Care Expenditures (Selected Calendar Years)

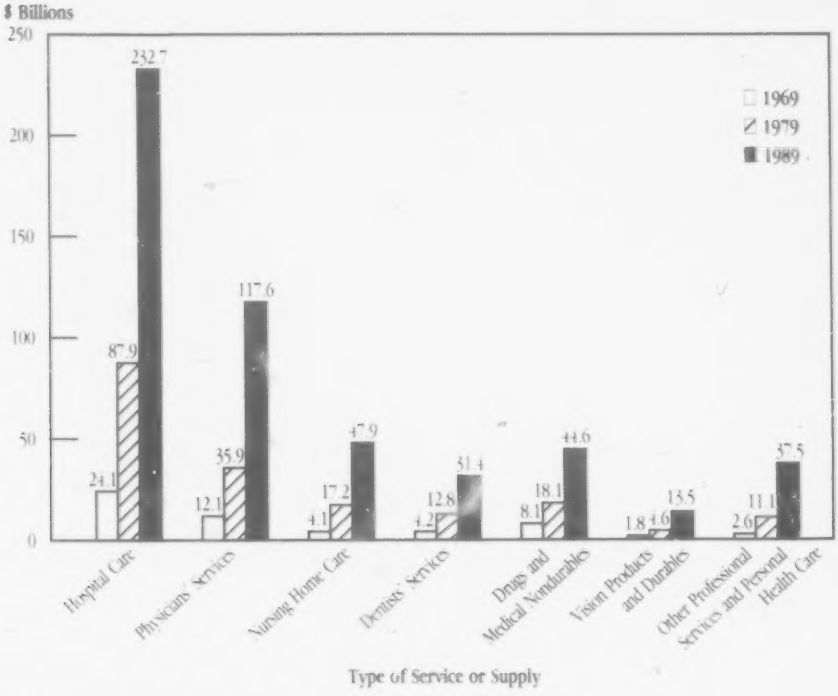


Source: Health Care Financing Administration

The Breakdown of Health Care Expenditures

Hospital care represents the largest proportion of expenditures and in 1989 accounted for 43.8 percent of all health costs. The next largest component was for physicians (22.2 percent).

Personal Health Care Expenditures

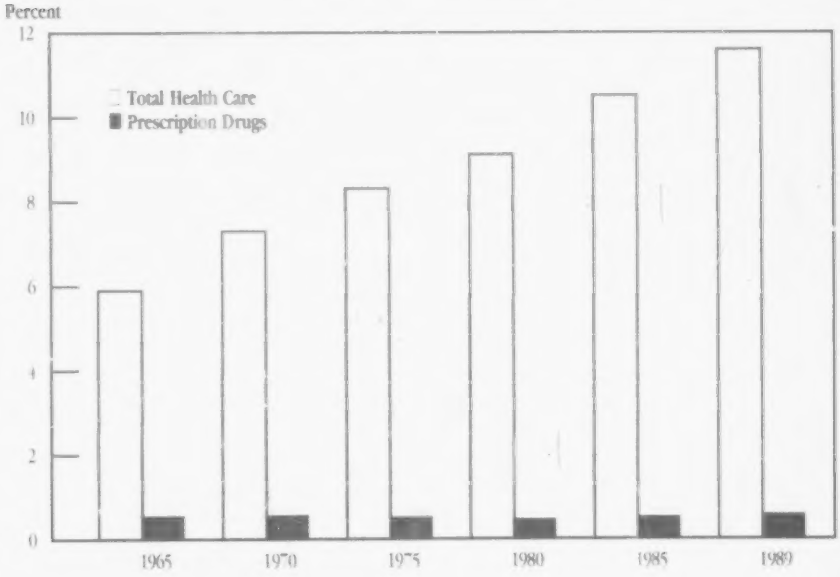


Source: Health Care Financing Administration

Health Expenditures as Percent of GNP on the Rise

More of the nation's GNP is going to health care. The U.S. is the world leader in per capita spending and percent of GNP spent for health. Yet, spending for prescription drugs has stayed under 1 percent of the GNP since 1965, while the percent for total health care has nearly doubled. And by reducing the need for hospitalization and surgery, modern medicines slow the growth in overall health care costs.

U.S. Health Care Expenditures as a Percent of GNP

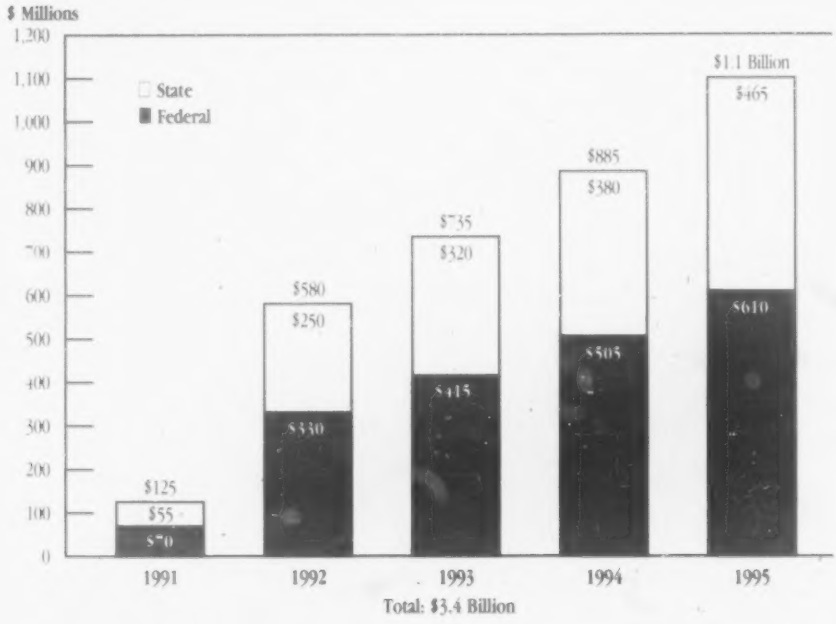


Source: Health Care Financing Administration

Savings Estimated to Result From the Medicaid Rebate Law

The 1990 Medicaid amendments to the Omnibus Budget Resolution Act will result in savings to the Medicaid program of $3.4 billion over five years, largely as a result of mandatory rebates. These begin at 12.5 percent of average manufacturer price to wholesalers in 1991, and rise to 15 percent from 1993 on.

Medicaid Rebate Law Estimated Savings, 1991–1995

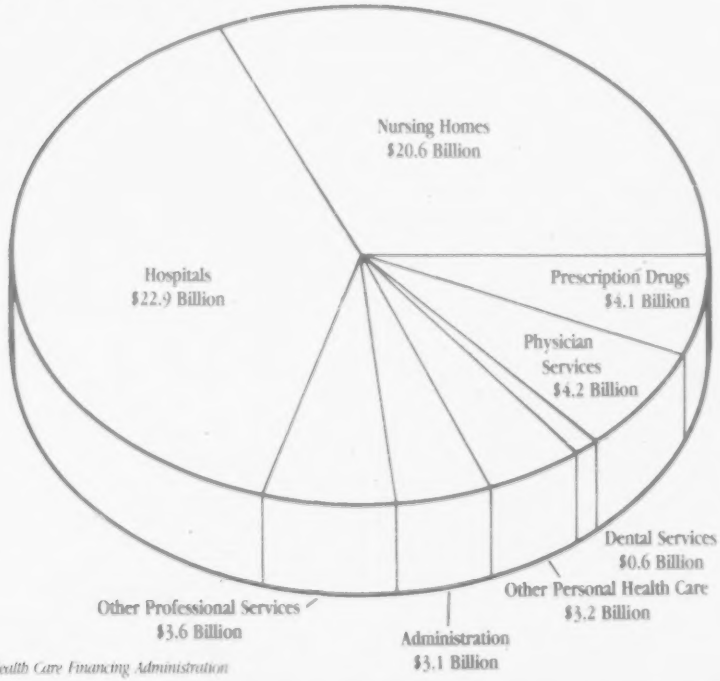


Source: Congressional Budget Office; PMA

Percent of Medicaid Expenditures for Drugs

In 1989, less than seven cents of every Medicaid dollar was spent on prescription drugs dispensed by retail pharmacists. Total Medicaid spending in 1989 amounted to $62.5 billion.

Medicaid Spending by Type of Service, 1989



Source: Health Care Financing Administration

Economic Benefits of Drugs

Drugs not only fight sickness and save lives, they also save money. They usually are the least expensive form of health care. For example:

• Based on industry and government estimates, the cost of treating ulcers with H_2 antagonist drug therapy runs about $1,000 per year and the cost of ulcer surgery more than $25,000.

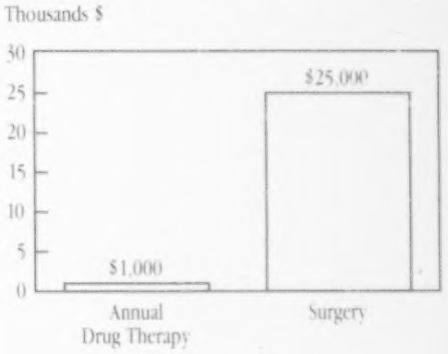
• Coronary artery bypass surgery is no more effective than prescription drugs in preventing heart attacks or improving survival in many heart patients, according to a Veterans Administration study. The average annual cost of a leading beta blocker and nitroglycerin is less than $300. The average cost for a coronary bypass operation is more than $40,000.

• The cost of surgery for gallstones is $12,000, including physician's and surgeon's fees, hospital costs for an average stay, medications and other standard fees. For cases where drug therapy is appropriate, the industry estimate for annual drug therapy with a gallstone-dissolving drug is less than $2,000.

• Hospitalization costs for schizophrenia in a state mental institution fell by more than $24,500 a year per patient after the first year of treatment with a new anti-schizophrenia drug, compared to a reduction of only $8,200 for patients treated with conventional drugs.

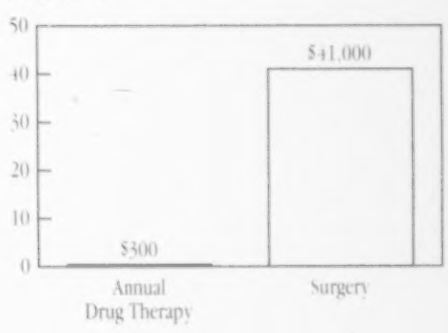
Treatment Cost Comparison

Ulcer



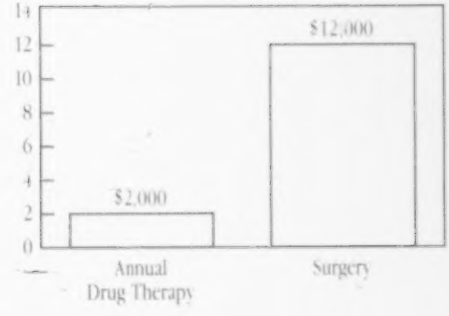
Sources: Blue Cross/Blue Shield; PMA estimate

Coronary Artery Disease



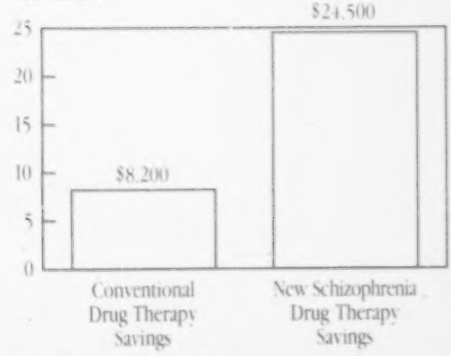
Sources: Blue Cross/Blue Shield; PMA estimate

Gallstones



Sources: Blue Cross/Blue Shield; PMA estimate

Schizophrenia

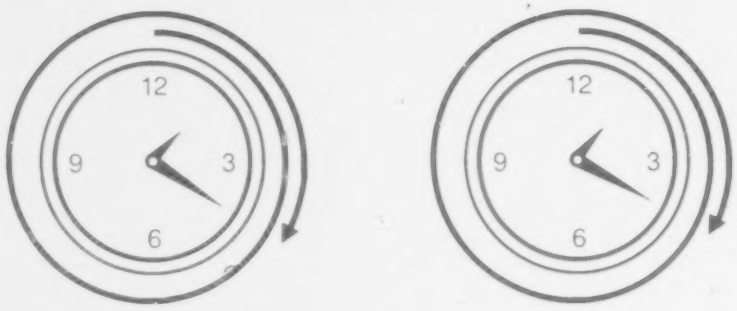


Source: Honigfeld, G. and Patin, J., Hospital and Community Psychiatry 41(8):882-5, 1990

Time Required for the Average Production Worker to Pay for a Prescription Drug

In 1967, it took the average production worker 81 minutes of earning power to buy a prescription. In 1990, it took 80 minutes.

Prescription Prices vs. Purchasing Power



81 Minutes
1967

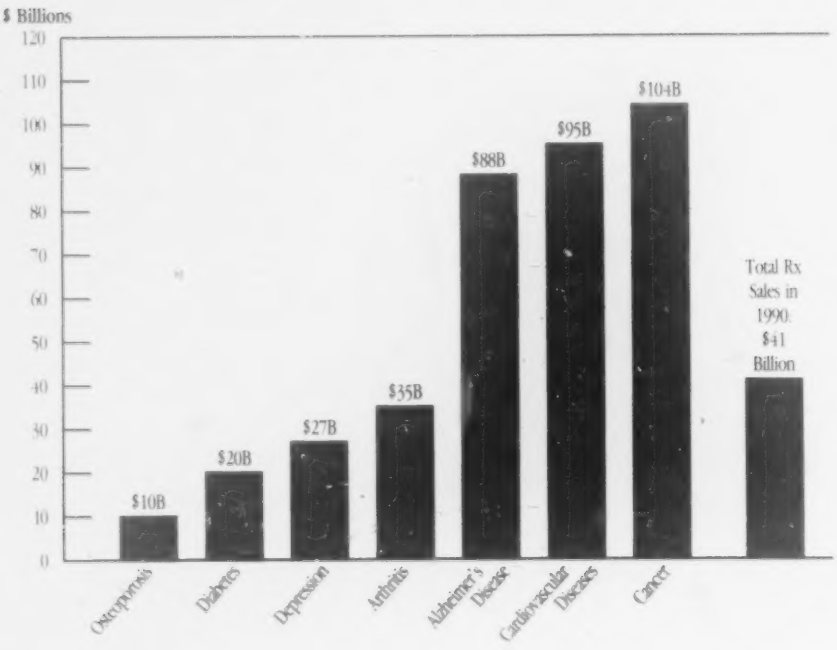
80 Minutes
1990

Sources: BLS, Pharmacy Times, PMA Prescription Drug Size Index

Uncured Diseases Cost Much More Than Drugs

For just seven uncured diseases, the cost to society amounts to an estimated $379 billion annually. This compares to just $41 billion in 1990 for all prescription pharmaceutical sales in the U.S. Drugs and vaccines successfully and inexpensively treat hundreds of other diseases—such as typhoid fever, polio and tuberculosis—that once were as costly as any of today's major illnesses.

Cost of Uncured Diseases
Total Annual Cost: $379 Billion



Sources: Alliance for Aging Research; American Diabetes Association; National Institute of Mental Health; Alzheimer's Association; "The National Economic Burden of Cancer," 1990; PMA New Medicines in Development Survey.

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